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THIRTY-FIRST
QUARTERLY REPORT

OF THE

PENNSYLVANIA

BOARD OF AGRICULTURE,

1886.

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THIRTY-FIRST QUARTARLY REPORT

OF THE

PENNSYLVANIA BOARD OF AGRICULTURE.

PENNSYLVANIA BOARD OF AGRICULTURE, 1886.

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Lancaster,	H. M. Engle,	Marietta, 1889
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Somerset,	C. C. Musselman,	Somerset, 1889
Schuylkill,	J. S. Keller,	Orwigsburg, 1887
Sullivan,	L. B. Speaker,	Hill's Grove, 1888
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Venango,	W. Gates,	Oil City, 1889
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LOCAL OR COUNTY FARMERS' INSTITUTES.

From the Annual Report of the Secretary.

Soon after the organization of the Board in 1877, it became evident that the desire of the farmers of the State to have a meeting of the Board held in their respective counties, could not be met by any appropriation which we had the right to expect the Legislature to make to a comparatively untried division of the State government. Invitations and requests for meetings far exceeded our ability to pay the necessary expenses of our members in attending them, and much disappointment and misunderstanding ensued, which, in some instances, has resulted in an injury to the Board in certain localities; those who were not granted meetings felt that they had been neglected, and that others were unfairly favored.

As early as in 1879, various attempts were made by the Secretary to obviate this difficulty, and to increase the number of the meetings without an increase in their aggregate expense. After carefully considering all of the proposed plans, the Executive Committee adopted, as the most feasible, one which provided for the division of the State into four districts, in each of which a meeting should be held each year, in addition to the annual meeting at Harrisburg. The district meetings were to be attended only by the members of the Board residing in the district, and thus the expense of a full meeting of the Board was avoided. This plan was adopted by the committee as the one most likely to solve the problem, but, not meeting with the full approval of the Board, it was not pressed to a completion, and until 1885, the Board met as during preceding years; but with each year the evil increased, until in 1885 the Legislature was asked for a special appropriation for "the expenses of holding local or county farmers' institutes." The request received the approval of both branches of the Legislature without a single negative vote, and the Secretary was directed to arrange the proper rules and regulations for carrying the plan into effect. Applications came in faster than the limited amount at the disposal of the Board would warrant them in granting, but institutes were assigned as nearly in the order of the application as circumstances would permit. At the close of the first six months of the appropriation year, more applications were on file than the Board could possibly grant during the two years for which the appropriation was made, and this has been the two years' history of the county institute fund, the demands always in excess of the ability to grant, and they have been constantly gaining in popularity. So great has been the approval of the farmers of the State of this move in their behalf that the Secretary would advise that the Legislature be asked, at its next session, to double the amount of the previous appropriation and assign two thousand dollars for this purpose.

It is worthy of note that the Western States have adopted this class of meetings, and they are meeting with great success. Secretary Chamberlain, of the Ohio State Board of Agriculture, writes: "We hold forty of these institutes during the three winter months. Five years ago, when I came into the Board of Agriculture, I submitted a

plan for winter institutes. They asked how much money would be needed, and I said to them, "If you choose to put one thousand dollars in bank, I would draw out what was necessary." The first year I used about six hundred dollars; we did not have any appropriation, special; the next year the Legislature increased the fund to six thousand dollars, and we nearly trebled our expenses." For the purposes of farmers' institutes, Wisconsin appropriates eight thousand dollars, Ohio six thousand, and Vermont enough to hold one institute in every county in the State each year; several other States also appropriate similar amounts for the same purpose.

By the plan arranged by the Secretary, the resident member of the Board in each district has the first right to a portion of the fund. His request having been granted by the Advisory Committee, it becomes his duty to arrange the programme of the meeting, he being limited in his arrangements and expenses to an amount agreed upon by the committee. This disbursement is governed by certain rules, and all bills must be approved by the resident member and by the Secretary before they are paid.

Since the appropriation was granted by the Legislature, the following institutes have been held: Titusville, December 22d and 23d; Lock Haven, January 21st and 22d; Honesdale, February 2d and 3d; Oxford, February 25th and 26th; Montrose, May 5th and 6th; Atglen, May 20th and 21st; Mifflintown, June 1st and 2d; Doylestown, November 10th and 11th; Washington, December 28th and 29th; Lewisburg, January 5th and 6th.

Similar institutes have been granted for Bloomsburg, Lock Haven, and Montrose, and several others will probably be held if the funds at the disposal of the Board will permit.

Without exception, the attendance at these meetings has been such as will warrant an increase in the amount of the appropriation for the purpose, and the success of the plan seems to be established upon a sound basis, with the hearty indorsement of the farmers of the State. In all cases the holding of one institute in any locality, if not followed by a permanent organization, has been the cause of a second request, and the general attendance and participation of the farmers of the district may be taken as indicative of the attempt of the Legislature and Board to benefit them by affording an opportunity for an interchange of sentiment and theory in relation to their calling. In several cases, special sessions were set apart for lady essayists, and the interest manifested by farmers' wives and daughters is an indorsement of the innovation in the general rule of managing this class of meetings.

PAPERS AND DISCUSSIONS OF FARMERS' INSTITUTES.

Titusville Institute.

Opening Address, by Hon. A. N. Perrin.

I have looked forward to this day with feelings of pleasure. I have been very anxious that this farmers' institute should be a success, and that our meeting together might result in profit to us all.

I esteem it an honor to address a few words of welcome to our

friends, whose presence with us to-day is an assurance that all that we had anticipated of good is about to be realized. This is the first farmers' institute held under a provision of the Legislature of this Commonwealth, made at its last session, placing a fund at the disposal of the State Board of Agriculture for "the actual and necessary expenses of conducting local farmers' institutes."

In assemblies of this nature, where men come together for mutual benefit, it is most important that the greatest freedom be enjoyed by all. That all may feel at perfect liberty, I wish first to say to our friends in the city, and to those from near and from far, that a general and a universal invitation is extended to them, not only to listen, but to participate in the proceedings and discussion of this institute—all are welcome.

Again, representing the Oil Creek Valley Agricultural Association, I desire especially to extend an earnest welcome to our friends from abroad, who have come here in our interest, to speak words of wisdom and counsel, in order to educate and advance us in the arts and sciences of rural and agricultural life.

For the time allotted us in this world this is our chosen walk and calling, both for usefulness and support, and desiring as we do to make the most and best of life, we gladly receive and welcome you to aid us in the accomplishment of this purpose.

I trust it will not be considered out of place for me to make brief mention of the early, continued, and indispensable aid rendered us in bringing about this meeting by the most energetic and efficient Secretary of the State Board of Agriculture, Mr. Thomas J. Edge. He first called my attention to the act of the Legislature making the appropriation, and advised us to put in an early application for an institute to be held in Titusville. From that time until now, nothing has been withheld or left undone on his part to secure the grand opportunity we enjoy to-day. You will be greatly disappointed to learn that he cannot, on account of serious illness, be present with us at this meeting. It was his purpose to have been here, and it was not until yesterday that he informed us, finally, by telegraph that he must give up, and remain in quiet at home.

While we are deprived of both the pleasure and benefit of his personal presence, the essays are here prepared by him, and will be presented in their regular order.

My friends, I hardly know what further to say in the few moments of your time I shall occupy. As often in the past, so now again, I assure you that I feel a deep interest in the cause we have met to promote. In the country, on a farm, was the place of my birth. It was the calling of my father to be a tiller of the soil, and that calling I followed until I passed my majority. I have never lost that interest, nor ceased to love the fields and the herds, and what I enjoy and love affords me pleasure to see perfected and possessed by my fellows. While it is twenty years since I left the old home and took up my abode with you, I can say that I experience no hours of greater comfort than when roaming over the fields still retained by us, and made sacred by the remembrance of the toil and saving of a father for his children.

Quite a number of farmers' sons—young men—have been in regular attendance at the monthly meetings of the Oil Creek Valley Agricultural Association, during the year just closing, and some of them are present here to-day. They are thrice welcome. They have some

evidence of my interest in young men. I have experienced and passed through all the struggles of which they are now in the midst. I know almost every hope and throb of their hearts. Desiring as I do their prosperity and happiness, I have been inclined to speak as I have, hoping to strengthen and inspire them to an increasing love and respect for the place of their childhood, and the avocation of their fathers. I will not take your time by arraying facts and figures to prove the wonderful magnitude and importance of the ancient and honorable calling of agriculture, and its bearing and influence upon all the employments and engagements of man. This has been done from time immemorial, and the evidence of it is recorded everywhere. The best, the purest, and often the wisest, men of all ages have found comfort and happiness in the quiet pursuits of agriculture. As it was the first, so it *must* be the last industry to engage the human race. It has had its ebb and flow in all the centuries past, keeping measure with the advances and declines of the inhabitants of the earth. Somewhat in this regard, we have a peculiar history of our own in this part of the State, and I want to speak a word in reference thereto. While we, as a community, have to acknowledge our happy and prosperous condition as having been produced by various causes, we owe much of our present security; and our hope in its continuance for the future, to development of the agricultural interests about us. Our forefathers were not planted in the Garden of Eden. Naturally, our soil was not over-generous in yielding its fruits in response to the tiller's hand, and limited in means, as early settlers usually are, it took long years of patient, self-sacrificing toil to show much improvement.

Something less than one hundred years ago, this country, then an almost unbroken wilderness, was penetrated by sturdy men. The Kerr's, Curry's, Ridgeway's, Titus', Gilson's, Stewart's, Irwin's, and Hancox's, together with many other honorable names, were the first representatives occupying the hills and the valleys about us for permanent homes. Originally, there was a great wealth of timber here, but when made ready for use and for market it brought but little money, while the lack of near consumers, and the want of transportation, postponed the day of prosperity. But that day has come, and while the father-heroes sleep, I see before me their children and their children's children in the full enjoyment of the prizes they fought to win. But this is not all of our story. As you have come here to help us, we want you to know a little more of what we have done for ourselves, and the time we have had to do it in. It was not until within about twenty-five years that the first material change appeared in the condition of the country, and that change was as disastrous to agriculture as the fires and the floods. Its cause and history are so familiar to you all that I will not speak of it, excepting in brief, as it had an influence and bearing on the subject we have met to consider. The breaking out of the oil excitement in this country, in the years of 1859 to 1861, opened new channels, and altered the course of all our affairs. For five to seven years, over a large area, there was almost a perfect cessation of all efforts to cultivate or produce anything from the soil. Hence, there was not only no progress made, but much that had been accomplished in the years that were passed, was swept away and lost, the earth alone being left. Every farmer was looking for a customer for his lands, and, sooner or later, he found him. Thus there was a change of possession and ownership, either by lease or sale, of nearly all the farms for miles about us. Then a second change came, and as

the lands proved either unproductive for oil, or became exhausted of the rich treasure, our thought turned back to the old ways, and many came into possession of their old homes again, and the process of rebuilding commenced.

This has been going on for fifteen or twenty years. The results for the time given have been marvelous. Meanwhile, railroads were built, this beautiful city sprang up, and our agricultural society was organized, all of which afforded ways and means for the advantageous and profitable development of the country about us. Taking all things into consideration, I do not know of a more progressive agricultural community than the one assembled to-day to receive your counsels.

In contemplation of our improved condition, and the blessings we enjoy to-day, we must not forget the debt of gratitude we owe to one who has passed from our midst. A useful man in all the affairs of life, our constant friend and helper, the Hon. M. C. Beebe did more than all of us to establish the society that has done so much to stimulate our thought, and put forces in motion to develop the agricultural interests of this section. He was known all over the State, through his connection with the State Board of Agriculture, and the many valuable contributions he made at the meeting of that body. Besides all else, he was to me, as to many others present, a warm, true, personal friend. Blessed be his memory, and honor be to his name, while we will all join in respect and sympathy for his family. But we must go on and occupy, giving heed to the living questions of the day.

Because we are farmers, we should not be limited in our researches or accomplishments. While it is necessary to be especially informed in the line of individual pursuits, we also realize the importance and advantage of a broad and general education. We want to know equally as much to be a good farmer as we do to be successful in any other calling or profession. It is not what a man needs to know simply to be a farmer, a physician, or even a teacher of other men, but rather his needs to become a *man*, broad, intelligent, wise, useful, and helpful in the world, and then whatever he may choose to engage his faculties, he will, by his force and power, bend events to his own improvement, and command success.

As we have already made our choice, the theme of greatest interest to us is agriculture, and how to produce and enjoy its full and legitimate profits and benefits. Knowledge is power; hence, we need not only to know how to produce the most and best, but, after having done that, we need to know how to retain and protect the fruits of our labor. It is a fact, as it has been stated, that all the great fortunes owned by so many American citizens, not one has been made directly by agriculture. All of them have been made in one way or another by the handling of the products of the earth after deducting a scanty support for existence by the patient, toiling millions who sow the seed and gather the harvest, who blast the rocks and smelt the ores.

Our labors and anxieties cease not with the producing. We must find a market, and here enters in the great problem of commerce and exchange, the legitimate fruits of which have rarely, if ever, come in full to the rightful owners. I will not attempt to discuss the question at this time, but, by simple reference, direct your attention to what seems to me to be one of the most important and difficult problems for American statesmanship to solve: "What shall the tolls be over the bridge spanning between the producer and the consumer, and how

shall they be regulated in equity and justice to all concerned?" It seems to me certainly not "all the traffic will bear," particularly and especially where the privileges are secured by the development of rights obtained by concessions and grants by the many to the few, called the "imperial right of eminent domain." There seems to be a limit beyond which there is a reserve to the State, and the people are the State. The various means resorted to to defeat justice, and deprive the producer of his fair share in the good things of a bountiful Providence, are all indefensible, and I earnestly hope to see the evil, in a great measure, corrected.

I have taken the liberty which, I believe, is usually conceded on such occasions, to refer, in a very general way, to the subject under the call. We have gentlemen present with us who, by essay and speech, will ably instruct in the way we should go, and in the things we should do to make our calling and election sure. Again, and finally, I say welcome, for our free latch-string was never drawn in against any child of Adam's kin.

Please accept my thanks for your kind attention.

THE MODEL DAIRY COW.

By WILLIAM FAIRWEATHER, *McLane, Erie county, Pa.*

Within the last few years, the dairy interests of this country have been assuming vast proportions. In this State, the counties of Crawford and Erie stand foremost in cheese dairying. The low prices which have ruled for cheese through two seasons have stimulated the farmer to look to the improved breeds of dairy cattle as a means of increasing his profits at the factory. The question which agitates his mind is, What breed shall I invest in? What breed is the most profitable? What he wants is the cow that will yield him the greatest possible profit for the smallest possible outlay. If he does not feel able to buy a herd of thoroughbreds, his thoughts turn toward improving his herd, and now that the pressure of work is over for a season, he has leisure to decide what kind of stock he will raise next year; whether he will go on in the old ruts and breed his cows to a scrub, or invest in a thoroughbred. The former may seem the cheapest and simplest plan to begin with, but it is not so in the end. The advantage to be gained by using a thoroughbred bull is no longer an experiment, but an actual fact, and it cannot be put too strongly before those who should benefit thereby. It is now agreed by the best authorities that "the bull is half the herd," which opinion adds confirmation to the well-founded belief that the best is none too good to breed from. I know of herds that have doubled in value by using a thoroughbred bull. Yes, I may say they have doubly doubled in value, for the animals themselves are worth about twice as much to sell as their maternal ancestors, and they will yield nearly double the quantity of milk in a season, which latter is also produced at a lower cost, and the outlay expended for getting into this improved herd is not worth mentioning. When a thoroughbred bull of a first-class milking family, fit for use, can be bought for fifty dollars, no farmer with a dairy of ten cows can afford to do without one. If he

does, he is losing money by it. The next point to be considered is the question of breed, and that depends a good deal on your location and what you propose to do with the milk. If you want butter alone, probably a Jersey will best suit your purpose. If you want quantity of milk, regardless of quality or cost of production, a Holstein will fill the bill; but if you want both quantity and quality of milk, an article either fit for the table or that will produce a delicious quality of butter at a small cost, there is but one breed that can do it, and that is the Ayrshire. I would here say a word to a numerous class of farmers who labor under the mistaken idea that it is necessary to have a large carcass for a dairy cow. Experience has proved this to be a great and expensive mistake. Just think of a sane man advocating the feeding of an extra five hundred pounds of beef on a dairy cow for ten or a dozen years, so that there will be that much more carcass to dispose of when she comes to the block! The idea is preposterous. I believe that the most profitable animal in my herd to-day is a cow that does not weigh over six hundred pounds. The trite saying, "Economy is wealth," is very applicable to Ayrshires, for their great point is economy of production. I have found no profit in large carcasses for the dairy; they are not economical. What the American dairy farmer wants is a cow that will yield the greatest quantity of milk, rich in butter and cheese-producing qualities, on the smallest quantity of feed. It is not enough that she will give a small quantity of extra rich milk, or, in other words, be a good butter cow; neither will it fill his requirements that she is a large milker, if that milk is of poor quality, deficient in fat or in solids, or, perhaps, in both. She wants to be a cow that will give a good flow of milk, fit either for the profitable production of butter or cheese, so that when one of these commodities is low in price, her milk may be utilized for the other. She wants to be of strong constitution and active habits, not a big, raw-boned, lazy animal, idling away her master's time loafing under a shade-tree, but plucky and industrious, determined to have the best bite in the pasture if energy and perseverance will accomplish it. She wants to be a cow of medium size, of economical build, of kind disposition, an easy keeper, a large and rich milker. In short, she wants to be an Ayrshire, for no other breed combines in one animal so many good qualities as this hardy Scottish breed. The best authorities in dairy matters in this country and in Great Britain have accorded to the Ayrshire the proud position of being the largest yielder of milk for the amount of food consumed of all the dairy breeds. I will here give some facts to show the superiority of the Ayrshire in the cheese dairy.

Last summer, Mr. R. J. Drummond, a noted cheese-maker from Canada, visited the Island of Coll, Scotland, for the purpose of showing some improvements he had made in the manufacture of cheese, and with Ayrshire milk he averaged one pound of cheese to eight and one tenth pounds of milk. He was most favorably impressed with the Ayrshire, and said: "They are by far the best class for cheese, infinitely beyond the ordinary American grade." Well might he say so, for we find that the average yield of the factories in New York State is one pound of cheese to ten pounds of milk and three hundred pounds of cheese per cow, per annum, while in the Ayrshire district in Scotland, five hundred to six hundred pounds of cheese per cow is the average annual yield.

I will now give the experience of a dairyman with his cows. He started by stocking his farm to its utmost capacity, or rather, I might

say, overstocking it. His herd at that time numbered sixty cows which yielded him about four hundred pounds of cheese a year to the cow, but the expenses of running such a large herd were so great, that it was only by hard personal labor that he was enabled to make both ends meet. Tiring of so much worry and drudgery, he resolved to reduce the size of his herd and improve its quality. Acting upon the simplest and most speedy method of obtaining this end, he sold off the entire lot of cows, and supplied their places with half their number of good ones, for which he paid from twenty-five to one hundred per cent. more. The new lot of thirty was put on the same feeding-ground that formerly kept the sixty, and they yielded more than double the amount of cheese, besides being managed at far less expense. His ambition was to make one thousand pounds of cheese per cow per annum, and so well did his new venture turn out, that he succeeded in reaching over nine hundred pounds of cheese per year to the cow. They were a fine herd of cows, and rolled out the milk both deep and long, and in a few years so changed the fortunes of their owner that he was enabled to let out his dairy and live on his income. I will now tell you something of the breeding of these money-making cows. They were a cross of Ayrshire on Shorthorn, the former supplied the milking qualities, and the latter the size. Any farmer can work into such a herd of milkers in a few years at trifling expense, and the dairyman who keeps two cows to do the work of one is not only badly out of pocket, but is indeed sadly behind the times. I have had considerable experience with Ayrshire crossed on Shorthorn and native, and believe that for the farmer of moderate means, there is no more profitable investment in the shape of a cow than such a cross. Good milking natives crossed with Ayrshire give a very economical cow—a good milker and easy keeper. I have seen such herds—medium-sized cows—whose milk at the cheese factory would, for the season, outweigh that of any herd of equal numbers carried there. Not only so, but another great source of profit with such cows at the factory is this: Towards the end of the season, when pastures are dry and bare, and cheese generally increases in price, they will hold well to their milk, thereby yielding to their owner a gain in revenue, when cows of the larger breeds will barely pay for their keeping.

Prof. Sheldon, the great British authority on dairy farming, says: "The Ayrshires are wonderful milkers, doing well in milk where most other breeds could hardly live. More completely than most other breeds they possess the property of converting into milk the elements of food." In classifying the different breeds for the dairy, he places the Ayrshires first for both milk and cheese, thus according to them the highest position for general excellence, for no other breed stands first in two classes. What is wanted by the general farmer is not an animal that requires heavy feeding to produce milk, but it is the cow that will yield the greatest quantity (quality always considered) on grass alone, or, in other words, the largest yield of milk, butter, and cheese to the acre. The sensational milk and butter records which we so often see reported now-a-days are of no practical value to the farmer as far as the merits of a breed are concerned. They teach him nothing except at how great a cost dairy products can be produced by overfeeding cows. The question is, not how *much* it will take to make a pound of butter, but at how *small* a cost it can be produced, and the only true test that will benefit the farmer, and prove to him what they can accomplish, and what he may expect with the same treatment

which he gives his native cows, is to put the thoroughbreds into the pasture along with the natives, and prove what they can do with the same fare and care as their much despised sisters. Such a test would show the thoroughbreds at their true worth, and afford those in doubt an opportunity to make a wise selection. During the past year, the manager of the Ontario Experimental Farm, Canada, has made several thousand tests of the different breeds of cattle, with a view of ascertaining which was the most suitable for that province, and when the cows were tested on pasture without other food, the Ayrshire stood at the head of the list for both butter and cheese, and in summing up the estimate of average money-yield of the different breeds for the season, the Ayrshire again stood at the head for value of milk, butter, and cheese. In conclusion, I would say, do not be misled by extraordinary reported yields of milk and butter, for it is not the cow that can, by extra heavy feeding and stuffing, be made to yield large quantities of milk that is the most profitable, but it is the cow that on grass alone will yield the best returns to the acre that is the profitable cow for the dairy farmer.

DISCUSSION.

Mr. CARROLL. I was much pleased with the gentleman's essay. It strikes me he was a little partial when he said nothing will show on the Ayrshire as much as the feeding of the cow will. Now, it is not simply the cow we want to feed for, but her offspring. We must lose on the cow if we have little calves and two-year-olds. Another thing he compared was the Ayrshire of Scotland to the Ayrshire of America; a comparison that is rather difficult, on account of the difference in pasture and climate.

Mr. JONES. I never have owned an Ayrshire, but I have heard it said that they have such extremely short teats that it is difficult to get the milk from them.

Mr. FAIRWEATHER. What the gentleman has said is quite true, or rather it was true. We have been breeding Ayrshires for several years in this country with a view to making their teats longer. The best breeders of this country have a good breed of Ayrshires with better teats. In speaking of the Ayrshire not being large enough for beef, I think a man who raises cattle for the dairy has nothing to do as to raising stock for the butcher. We can raise Ayrshires as easy as Shorthorns. The way Ayrshires came to have short teats was this: It was the fashion to have short teats on the cows, and everybody went to raising short-teated cows. Now it is the fashion to have large-teated animals.

Mr. LYONS. I claim that we can raise an Ayrshire up to two years old without grain as easy as you can Shorthorns. Give grass in summer, mash in winter.

Mr. SLAYTON. The farmers all over this country don't feed a cow as they should after she has done giving milk and before calving.

Mr. FAIRWEATHER. My plan would be to feed the cow after she has done giving milk thus: I would give the best hay, and a little grain toward spring. She would do better and bear easier. I would say something about feeding grain. Cheese factorymen and dairymen say best cheese and butter comes from a cow that has been grain-fed in small quantities. I think the cow that can give a large yield of milk, that is, of good milk, from pasture, and is not very wasteful, is the cow for the farmer. I am not against feeding grain; I would rather feed grain to my cows winter and summer, but it does not pay.

Mr. RUSSELL. I don't know that I have thought of this subject. We don't live in a dairy country. Mr. Fairweather had a very nice essay. I could not take much exception to what he said. I notice that there are not many cows that give one thousand pounds of butter a year. I notice that they have touched this point. The cattle that prosper best in this country are the all-purpose cattle. In respect to beef, there is a kind of cattle that will bring good beef results. They are the cattle that make the best working cattle. I like to combine all in a cow that I can. I suppose I am allowed my choice. I will take the Devon cattle. I haven't figures about me, as I did not expect to be called upon. I have reports sent me of cows that will yield twenty-two pounds of butter in a week. I have no word to make with this, but I have no other cattle about me. What kind can we produce that will equal them in comparison to the amount of feed consumed? Also, the cattle that will make good working cattle are the kind I think should be taken. The Devon is that kind; they are the largest in the world. Perhaps the gentleman who favors the Ayrshires is prepared to dispute me, but this is my opinion. I notice in my farming there are those who are always hungering after something new. If a new breed comes up, they invest in that; if a new kind of fertilizer is offered, they buy that. They never advance, but are always falling behind. I just want to content myself with what I have. I think it is a fact that other animals will produce, with the same amount of feed consumed, more profit than

the Ayrshires. We do not want new breeds; more investigation is needed into the wants of the old breeds. Man never can do any good by making new breeds; we want to improve the old. If a man does not like farming, he had better go at something else. I would like to have a cow like the Irishman's, who said he had a cow that gave milk all the year round. When asked how that was, he said: "She came from a cow that never had a calf." As I understand this meeting, we came here for mutual benefit. We all need this, and we need to benefit ourselves regarding our cattle. Let us have an animal adapted to all the best uses. I advocate an animal for every purpose. We can use her with most of the different breeds. We must have them, for they are all good breeds. The American breeds are all good breeds. I claim they all have excellencies. These are breeds for the farmer—if the farmer is West, if the farmer is South, or if the farmer is East. I am a friend of the Jersey. I am a friend of the Ayrshire. I would like you to properly cross these breeds. I have studied it considerably. We must all study it more. We want to show which is the best breed. We don't know; we must investigate this matter. With proper investigation we would be authority on this matter.

Mr. FAIRWEATHER. I think the gentleman who last spoke is right about the general purpose animal. I think the cow that has the most good points is the cow for the dairyman.

QUESTION BY A MEMBER. I would like to know which kind is best able to get its food and make the most milk from its pasturage.

Mr. FAIRWEATHER. In answer to this question, I mean to stick to my Ayrshires. I suppose most of you have heard of Scotland. The people there don't have very many cattle. In the northern part, the breed is rather small. In the southern part, there is the Shorthorn. A Shorthorn would tire in the hilly districts and would not be profitable. The people there need a cow that can climb the hills; they need one that is industrious. The Ayrshire is that cow. She will climb over underbrush and stumps, leap fences, and find food where another cow would starve.

Mr. JESSE SMITH. I had an industrious cow once. She was so industrious that she was on every other man's land. These industrious cows that leap fences and climb over underbrush are not always the most easily found cows.

Mr. RUSSELL. One advocates an Ayrshire and another a Devon, while no one advocates a cross breed. I don't think there is any breed of cattle that equal the Devon. I once had a cow of that breed crossed with an Ayrshire; she was the blackest cow I ever saw. She was a good feeder and always in order. I think this cross makes good cows.

Mr. SCHRIENER. I would like to ask if the crossed breeds are good feeders.

Mr. ——. I have a cow that is three fourths Durham, and one of these industrious animals. I put her in a stall by herself. The industrious animal was always uneasy and in want of food.

Mr. SCHRIENER. Take a man that is sitting around and lazy all his life. Take one, like myself, that is always a little nervous and crazy, and look at the difference. It is the same with the cow. A lazy animal does no good; a nervous one does.

Mr. FAIRWEATHER. I think the gentleman who has just spoken is quite different from an industrious cow. An industrious cow when running around is always picking up something.

EXPERIMENTS IN FARMING.

By M. W. OLIVER, *Springboro', Pa.*

The grand distinction of scientific farming is that it rests upon experiment. Our idea of what would happen, and abstract theory of what must happen, are each dismissed, and that which *does* happen is learned from hundreds of experiments, each step of which has been carefully measured and recorded.

Science has made progress—great progress—and we have confidence in it, because of the tens of thousands of experiments which have been made, each element of which has been faithfully noted.

It should no longer be said of agriculture that it ought to be, *it is* becoming, a science. Practical farming *is* becoming, and *ought* to be, a branch of applied science. For agriculture has to do, not only with the growth of desirable plants and the use of the products of the soil to the greatest advantage, not only for the help they can give in cultivating the crops, but the breeding and rearing of animals, which is

coupled with the growing of plants. Agriculture, therefore, is the propagation and development of life, and the collecting, storing, and using of the products of life. But life is the most complete manifestation of the powers of nature; its mysteries are the most intricate, the most difficult to unravel and read, of all those which physical science has undertaken to master. The farmer, therefore, is a new man, whose business it is to apply this most difficult of sciences—the science of life.

From professedly scientific men, who, in their laboratories, detect and tabulate the elements of life, the facts and laws of its action, much information can be gathered. But he need not depend wholly upon others. There are a great many facts of the utmost importance, which farmers can settle for themselves, as soon as they have learned to handle that one instrument of research, from which modern science has learned almost everything which it knows—experiment.

It need not seem strange that farmers, as a rule, know not how to make useful experiments. Even among scientific men who have had considerable training in experiments, only a few have become masters of the art.

To make a really satisfactory experiment, knowledge should be had of what will be the result, when things are left to themselves, or as nearly so as possible. To illustrate: If experimenting upon the value of different foods to produce milk and butter, we must know what those same cows would give if fed only grass in summer and hay in winter. If experimenting upon the value of different fertilizers, we should know what the same soil would yield with no dressing at all. And now that it is claimed by some that cultivation is fertility, if we would know *how much* cultivation pays best, we should know what the soil operated upon yields, when worked only as much as the average farmer works his soil. And though possessed of *all this knowledge*, we shall find it *more* difficult to make a satisfactory experiment than one might suppose. The soil may retain some elements from last year's fertilizers, or be thrown into a state favorable or unfavorable to the particular crop under trial *by* the crop of the previous year.

The history of the soil must be known. Heavy rains may wash out your fertilizers, spread and mix them with each other.

The cow fed on bran may do better or worse than the one fed on meal, and yet the difference may be wholly in the cow herself. If testing the dairy to ascertain whether it is kept at a profit or at a loss, we should not only test the dairy as a whole, but should test each individual cow in the dairy. You will be surprised at the amount of knowledge these experiments will develop. You will perhaps learn why it is, when like care has been given the milk and cream, sometimes you make butter of like quality, and again it is very much off flavor. Sometimes the good housewife is surprised to learn, that though one of the five cows of the dairy has been sold, she is still making quite as much butter as before and now of a uniform quality; and she is no longer found fault with, for now her butter is always good.

It is a fact that some cows furnish a milk that always makes a high quality of butter; others furnish a milk, which, though it contains the necessary amount of fat, and is, to all appearance, of excellent quality, yet never furnishes butter of good quality. Should you make a test of the merits of each individual cow in your dairy, and find the foregoing, as outlined, true, would you not find it a source of profit to

eliminate the inferior animals from the dairy? Four cows as good as five—think of it a moment—and the weeding out of the fifth means the saving of the first cost of the cow, and the annual cost of her food and care. If farmers would take the time to ascertain the amount of milk each cow gives daily, and to churn now and then the milk of each cow separately, they will learn which brings them a profit and which brings them a loss.

There are, of course, many comparative results which may be obtained by experiments—by simply interchanging or reversing the elements. But, in all cases, to determine the original and inherent power of the land, or animal experimented upon, will make the experiment more satisfactory, and, in many instances, it gives to it its whole value.

Another condition of decisive experiments is that we try only one thing at a time. All scientific experiments are made by measuring differences in the results caused by differences in the conditions, and the secret of success is to know how to change just one condition, leaving all the rest unchanged. Even in their laboratories, with everything comparatively under their control, physicians have often been sorely puzzled to do this; how much more difficult must it be for the farmer, under the changeable sky, and liable to various interferences. Yet he must do it if he would obtain any decisive results from his experiment. To illustrate, if an experiment on a field of potatoes is made with commercial fertilizers, the experimenter will find that cultivation and fertilization go hand-in-hand together. It is not enough that a man pray "lead us not into temptation," and then rush from the closet into temptation, when duty calls him not there; he should watch as well as pray. Nor is it enough that the fertilizer be applied, but every opportunity offered should be taken advantage of to aid the fertilizer to do its work. In a moist, cool season, the ground will not need to be stirred as often, nor will the tubers need to be covered as deep as in a dryer or warmer season; and again, during a continued drought the soil needs stirring oftener still, and at a different hour of the day, than if more favorable weather prevailed.

The whole plat of ground should be previously made as nearly uniform as possible, and, if different fertilizers are used, these strips should be separated by a dead furrow to make sure that they cannot affect each other. The seed should be the same, and prepared in the same way for all the strips, unless the experiment is upon the value of different strains of seed, or the different way of preparing it; and the seed should all be sown or planted upon the same day, unless the object is to learn the best date for sowing; otherwise, change in the weather may complicate results, and the cultivation should be identical in each strip, unless the object is to learn what amount or method pays best. An illustration of what difference a few days in time, as well as depth in planting, makes, and how the results of such difference sometimes gives credence to old whims or theories, if you please, was told the writer by an ex-official in the western part of the county. A piece of ground of uniform fertility was planted in potatoes by himself and a neighbor. The seed was alike and prepared in the same manner. The ground being in condition, the first planted his portion at his usual depth of planting; the other waited a few days till the moon was on the wane, when he planted, and, as the ground was getting rather dry, planted at a greater depth. Each piece was cultivated alike. The season continuing rather dry, the deeper planted, or, as the moon the-

orist would say, "planted in the moon," yielded the better crop. Each failing to recognize the cause of this difference, each one's faith in the moon theory was strengthened.

There are different theories and systems of cultivation. Would you test any one of these systems, and be profited thereby, you must adopt it as a whole. In making experiment, that yourself as well as your brother farmers may be profited thereby, an account of the whole should be kept in detail, for memory sometimes proves worthless when unchecked by paper and ink. The experience of scientific observers and experimentors has proved that the whole process of an experiment must be kept account of in order to secure such knowledge of what was done, and what the result was. Men whose honesty is as bright as a new dollar will unconsciously mix up their theories, or expectations, or disappointments with their memories of facts, and others who do not intend to deceive themselves or cheat others, are unconscious cooks of their reports, each according to his temper of mind. How often do we hear the man who is given to boasting telling what great things he has got from small things, and again we hear another lamenting over the little he gets from much, and yet we know the difference is really in the men—in their tempers, not in their crops. You know that if each had kept an account of the precise acreage cultivated, the depth to which it was plowed, the quantity of fertilizer used, the time of labor, the cost of seed sown, the history of cultivation, the quantity of crop harvested, there would have been no variance in the two records. Some valuable experience can be gathered without such a record, but to obtain full and decisive results from our experiments, it is absolutely essential.

Success in life is a question of ratios. It is not the absolute quantity of a crop that makes us rich or poor, but the ratio of the crop to the whole expense for land, tools, fertilizers, labor, etc., which settles our fate. This ratio is known only to him who has kept an account of his labor, and every other item of expense, in such a way that he can tell at the end of the year just what he has done, so the account shall read the same whether he is looking for a debtor or dodging a creditor. It may be that, in recalling the year's work, he may correctly sum up the results and rightly judge the interpretation of the experiments, but if he has no record to refer to, his experiment has mainly lost its value as evidence, the one thing for which it was made. An experiment must be carried out to the end faithfully and industriously. There is a class of men who are always experimenting, and whose farms show plainly enough that they are not farming. They plan enough experiments and commence to carry them through, but alas! every one of their experiments is at last turned into the same one question, "Can this thing survive neglect, weeds, and starvation?" It is not worth while to try new plants, new fertilizers, new tools, if at the least your crop is not to have the soil to itself. It is waste of time and care to provide that your plants may compete with each other, if at last the only competition is to be with the weeds.

Something may be said of the opposite error made by those who think that to try some new thing is to fondle and pet it to the neglect of the familiar and common. The highly pedigreed and high-priced cow is treated royally, but the others are quite neglected. The new rose with a jaw-breaking name has plenty of manure, hellebore, washing and pruning, but the old standards are left to slugs and lice. The famous new strawberry, bought on the strength of a picture large

and bright as the rising sun, gets all the fancy care the possessor knows how to bestow. They see, or think they see, a wonderful difference between the new and the old; and if they get results proportionate to their outlay, they do prove by their tests that the new has worth, but they have not shown it to be in any respect better than the old, or that they can afford the expense involved in changing. Ignorance, if there happens to be wealth behind it, can do all this. Our largest crops upon our richest acres sometimes yield us little or no profit, for the reason that they are wasted in the using. Intelligence must direct all—from the breaking of the sod to the use of the crop in producing other forms of growth—before any claims to thoroughness can be allowed.

There are in fact two different questions to be asked by experimenters upon new crops, new breeds of stock, new implements. The one is, what is the utmost that can be got out of them? The other, what may I expect them to yield under such care as I can give on my farm? The practical experimenter seeks to answer this second question. Another sort of men who cannot succeed as experimenters are the impatient, those who jump at conclusions, and reject or praise an article before it has come to maturity, who cannot wait to see the results, direct and indirect, of their operations, and seem always to expect that everything which Nature makes must be utterly worthless or exclusively good.

In conclusion, we would add that a full and wisely planned system of book-keeping would confer upon each year's routine of labor much of the peculiar value of a course of experiments. I think I can truly say that farmers in general do less book-keeping than any other class of men. How many farmers are there who can give the items of their expenses? The creameryman books his milk, the thresher measures his grain, but who measures the labor of producing milk and wheat in such a way as to make it possible to know how the net profit of the two compare? How many of us are every year carrying on operations of which our experience and observation have taught us that they can be done more easily in one way than in another? And yet are we sure that it pays to do them at all, in any way, or whether it might not pay to engage in them more extensively? Any farmer who will take time to keep a full account, not only of money and goods, but of time, and who would study that record till he knew the net profit to him of his corn, wheat, cattle, etc., and also the net profit of his fields one by one, will find the time so spent the best paying hours of the year. He might learn that some branches of his work do not pay and that other branches might be pushed with profit. Thus would each year's work become an experiment, answering the question, does the work done in this way pay me?

HOW TO BRING UP A WORN-OUT FARM.

By WILLIAM GATES, *Oil City, Pa.*

It has been a serious problem with many farmers to know how to restore land that has been exhausted by a bad system of tillage. The pioneers of this section of the country were poor people, and to make homes in the wilderness was no easy task. Scientific investigation

and book farming were not known. Suitable implements to cultivate the soil were not to be had, and a system of double cropping and pasturing continued until nothing more could grow, and then the land was abandoned to briars and weeds until it could recuperate by rest and natural cases. To restore worn-out land, the first step should be to remove all obstructions, to take down the old worn rail fences, and replace with straight fences, made of post and rails, or boards, or wire. By so doing sixty perches of land will be added to tillage on a ten-acre field, and save the labor to clean out the old fence corners of noxious weeds and useless brush and briars. The next step: all wet land should be underdrained; this can be done cheaply, thus—dig a ditch two and a half to three feet deep and eighteen inches wide from the spring, or source of supply, and place a stone about one foot high against one side, and another stone eighteen inches on the other side to lean over against the first stone, to serve as a brace to hold the first stone in position; this will leave a cavity to convey the spring water; then fill in small stones to level up, and you will have a drain that will not only convey the water from the spring, but also the surface water. By using the stone in this way, you make two points at the same time: first, by removing an incumbrance from your land, and, second, by placing them out of the way and making a good and efficient drain. But if you do not have the stone on your premises, buy tile, or use any other material that will bridge a cavity to conduct the water from the land you intend to cultivate. It will not pay to cultivate land that is constantly saturated with spring water. After drainage has been made, plow nearly the depth of the soil (and, if available, at reasonable cost, apply one hundred bushels of slacked lime per acre, to neutralize the acid in the ground and prepare the soil to feed a growing crop); plant to corn or sow to oats or barley; if to oats or barley, sow mammoth clover. Let clover stand till ripe; cut the top for seed, with reaper; plow under the clover stubble, pulverize thoroughly, top dress with manure, and sow with wheat or rye; follow with corn, plow late, pulverize thoroughly, check-row three and a half feet each way, drop three grains in a hill, cover with a hoe, (if early, four inches deep, if late, two inches deep,) work the corn early and thoroughly, follow with oats or barley, plowing two inches deeper in the fall to deepen the soil, and bring to the surface a clay sub-soil that will prevent too rank growth of oats or barley. The clover seed that was plowed under with the stubble will probably seed the ground sufficiently, and if so, let it stand until next season, and cut the seed as before, and top dress with manure or commercial fertilizer, and sow to wheat or rye. By following this course of rotation of crops, you can secure a crop every year, and your land increases in fertility, provided always, that you do not let any stock run over it and tramp the life out of the soil. It is useless to spend time and seed in cultivating land in a careless manner and expect remunerative crops. Thorough cultivation is required, on the best of farms, to insure large results. No hay, straw, or feed-grain should be sold from the farm, but should be fed to the stock that will pay to keep and feed, and the products of the farm converted into live stock, dairy products, poultry, wheat, and meat. Horace Greeley, in his lifetime, told a great deal of what he knew about farming, and among other things, said that the best farmer was the one that made the most manure. A great loss is sustained by many farmers by letting their manure lie in the barn-yard for months, and sometimes for years, and when it is carted to the field there is nothing left but the

fiber. Manure should be carefully collected and kept under cover; care should be taken to keep it from burning while decomposing; water should be applied with a hose or otherwise to wet it, but not enough to leach it. By close attention to it in this way, the liquid will be absorbed and the ammonia retained. The man who sells hay, straw, and coarse grain off his farm may accumulate money while times are easy, and while his farm has so much of the richness of the virgin soil left, that it can endure a few years of absolute starvation without immediately giving evidence of the extraordinary strain that is being put upon its resources; but sooner or later the day of reckoning must come to the farm that is systematically starved in this way. Clovers of all varieties are the best green crops to plow under for fertilizing the land, but too many farmers deceive themselves and cheat their farms by sowing clover to fertilize their land, and when haying time comes cut the clover, make it into hay, and sell it off the farm; and still worse, turn in their stock to eat the blade, and tramp the ground as hard as a board, and wonder why their land will not produce good crops. It seems to be the prevailing opinion that timothy is an impoverisher of land, but your writer is not of that opinion; it is a tender plant, more easily killed than wheat by late frost. I seeded four acres with timothy and mammoth clover, as they mature at the same time, excepting that in two or three years the clover would be killed out and disappear; but close observation taught me a lesson. In a warm-growing season and no late frost, the grass was nearly all timothy; when the season was dry and late frosts, the grass was nearly all clover. This lot was not pastured by any stock except sheep in early winter. After cutting a good crop of grass for eleven years, I plowed down the sod, top-dressed with manure, sowed to wheat, had a good crop, followed with corn; sowed with clover the last time the corn was cultivated; catch was good; the next season the clover and other green stuff was so heavy that it was difficult to plow under; sowed to wheat, had heavy crop, followed with corn, etc., etc. You must feed your land if you want it to feed you, and the cheapest way to do this is with manure and green crops. It will not do to depend on ground lime, or even slacked lime, for neither possesses plant-food. Nor will it do to depend upon commercial fertilizers. It is true that they will stimulate and help the plant to start and increase the crop, but they cost too much, and can be supplied by other material more lasting on the farm. Recapitulation: Take off all obstructions, under-drain all wet land, apply lime to neutralize acidity in the land, plow well, harrow well, top-dress with manure or commercial fertilizer; sow wheat, rye, oats, or barley, and seed to clover to plow under when ripe; follow wheat and rye with corn; follow corn with oats or barley; after oats and barley, wheat. By following the above rotation, you can get a crop every year, provided you do not pasture any stock on the land you cultivate in field crops, and your land will increase in fertility.

DISCUSSION.

A MEMBER. I merely rise to indorse what the gentleman has said. I think he preaches solid truth. We had better take in what he has said.

A MEMBER. I would like it if he had commenced with land that was worn-out, and told us how to get clover to grow on it.

MR. CARROLL. I would like to know what the gentleman considers worn out land; whether it is land that remains after all elements of plant-food are taken out or not. There are eight thousand pounds of potash on an acre of land. It will take a great while to take this out. I would like to know what worn-out land is.

MR. GATES. I will only say in reply, that land which is not producing anything is worn-out land. That is the reason I advocate buying lime.

MR. RUSSELL. I think Mr. Gates said that land that will not produce anything is worn-out land. We have no land but what will produce a little something, but what I mean is land that will not produce a crop. I think Mr. Gates has done justice to the subject. I would also pasture sheep on barren land. Why, I see land in this country that is worn-out. Sheep will pasture on that land in preference to any other land. To my own personal knowledge I have seen sheep pastured on land that could produce but little, and in a few years the land was fertile. I think Mr. Gates' plan for enriching barren land is a very good one. For land that will not produce a paying crop, there is nothing that is any cheaper than lime or clover seed. Sow about fifteen pounds of clover seed to the acre. Mr. Gates has told us how to start clover by a light top-dressing. When I was young, and began farming, I took lessons from a German. He said he took a worn-out farm and moved on it at once. The large farm wouldn't produce enough of anything to pay him for farming. He applied clover and manure the next year and fell behind. The third year he filled all the barns on the place with timothy and clover. I have never brought up any worn-out land, but I have seen a great deal of it done. I think Mr. Gates' plan is a very good one.

MR. SCHRIENER. It seems that every man has his hobby. I think what we need in this part of the country is a chemical laboratory where we could take some of our soil and have it analyzed. Then we would know its constituents and know what would best grow upon it. It would be a great saving to the farmers of this section. We would know what to put on the land to make the proper plant-food. There are spots on my farm that will not produce anything, and right alongside of it corn will grow six feet high. Now, why is it? We do not know, but if we had a laboratory we soon would know. I believe Mr. Gates said something about raising barley to bring up worn-out land. My plan of manuring is to draw it on the dry land, where it will stay. If it is drawn on every day it is better. That is a cheap way; it is always out when spring comes. One cheap way to manure is by clearing up all the manure about our houses. I have known a good many men who have started out to buy fertilizers, come down to barn-yard fertilizing. About the suggestion of raising barley—can we make it profitable in this country? Barley is a very nice crop if we don't have to go too far after a market. The Lake Shore district is peculiarly adapted to the raising of barley, and the market for it is right there. We have no market here for barley. If we take it to Erie we may strike a poor market and we will have to sell it at a loss.

A MEMBER. I would like to ask if timothy grass impoverishes land. I believe Mr. Gates referred to it.

MR. CARROLL. I don't like to take up much time. We have heard a good deal said in regard to worn-out farms. Our wise men tell us that land contains twelve hundred pounds of nourishing elements. Two hundred bushels of potatoes will take up about forty pounds of the good that is in these elements which are in the soil. Some of these elements cannot be used, so we want something that can convert them into plant-food. This can be done by fertilizers.

MR. KERR. In the gentleman's essay, the first thing he speaks of is his own farm. I would like to ask the opinions of the farmers on this. I think it is evident that the most unproductive farms in this part of the country are those that need underdraining. I think I have gotten my draining done cheaper by contract than by paying by the day. I have underdrained from a swamp and other places on my farm. That which was of no use before now produces the best crops on the farm.

A MEMBER. I think underdraining costs too much to make it profitable.

HOW TO KEEP BOYS ON THE FARM.

By THOMAS J. EDGE, *Secretary Board of Agriculture.*

During the nine years in which the correspondence of the Board of Agriculture has passed through the hands of the writer, the above problem, in some of its many forms, has been presented by parents who are anxious for the best welfare of their children, and our answers have always been directed somewhat in the following line of thought:

It is neither practicable nor desirable that all farmers' sons should remain on the farm and become farmers, nor do we wish to devise means for keeping them there. The successful farmer is not made such by anything which we can enforce into his nature any more than is the civil engineer, the scientist, or the specialist in any other branch.

If a boy has not within him a liking for the calling, it may be best that he should select some other calling, and that he will be more successful therein. It has been asserted by an eminent writer that, all things being equal, boys would choose some other occupation than that followed by their fathers, because, during their childhood, they had seen so much of the business as to have become tired of its minutia. Whether the reason given is correct or not, we are not prepared to state, but that there is some truth in the assertion cannot be doubted.

Nevertheless, the parent who is a farmer, and recognizes that his calling is one of the safest and best that can be engaged in, still has the power of doing much that may influence the boy in the selection of his business for life.

First of all, let him implant in the boy's nature a just conception of the business as compared with that of other men; teach him to make a just and fair comparison of the profits of the shop with those of the farm; do not ding dong into his ears the idea that farming is but a slow and hard way of making a living; do not always hold up to his view the fact that the son of neighbor Jones went to the city twenty years ago, and is now rich. There is no harm in letting him know this fact; but, with it, have him remember that at about the same time nine other country boys went to the same city with as fair prospects as the son of neighbor Jones, who are still slaving at their desk for a small salary, with fifty more waiting for their situations should they be sick, or, from any cause, give them up. Let him see both sides of the question, and with one follow the other.

If you point out to your boy the fact that Smith makes ten per cent. upon his capital as a stock-broker, do not neglect to show him that nineteen others fail to make even a good living; and do not let him lose sight of the fact that the total capital invested in brokerage does not pay two per cent. upon the investment; let him see that for each Vanderbilt we have a dozen Enos and Wards. It will also not be amiss to show him that after Smith pays his family expenses his ten per cent. is all absorbed, while the three per cent. made by Farmer Robinson is so much clear gain, the expenses of living having first been deducted.

Let him note the fact that out of every ten business men in our great cities, but one gets rich, while the other nine barely achieve a comfortable living, and many of them do not know where the next month's expenses are to come from; and further let him see that the one who gets rich is working hard to amass capital enough to purchase a farm in the country upon which he may live with his family.

Let him see that if two hundred thousand dollars is equally divided among ten average farmers and ten business men, that, at the end of twenty years, the farmers will have accumulated the most surplus capital or profit, and will have this surplus most equally divided; that, of the ten business men in the city, one will probably have both capital and profit, and the other nine will have passed out of view as business men.

Many boys have been literally driven from the farm by the treatment received during boyhood. The writer has a vivid recollection of the time when the dullest scythe, the poorest hoe, and the most monotonous work were good enough for a boy, simply because he was a boy. Constant labor, from daylight to dark, with little or no intermission for amusement, has driven many a farmer's boy to seek a precarious living in our large cities. Do not work the boys too hard. The farmer

who will hesitate to put his two-year-old colt to steady work does not always make the same exception in favor of his son of fifteen, and yet the colt is better able to endure the work of the full horse than is the boy to do a man's work. In the words of an old, successful farmer, "If you want the boy to stay on the farm, do not bear too hard on the grindstone when he turns the handle."

Teach the boys that profitable farming will give as much scope for brain exercise as any other calling, and that the field for the use of brains on the farm, and in connection with farm work, is widening every year, and that the time is not far distant when the successful Pennsylvania farmer will use more brains and less muscle than he now does, and that, on an average, the demand and need of brains in agriculture will produce as good results as in other callings. Show the boys the agricultural improvement of the past twenty-five years, and lead them to expect that the improvement of the coming twenty-five years will be as marked and as important.

Another very important item in keeping boys on the farm, and also in driving them away from it, is the nature of the reading with which they are supplied. The boy's mind reaches out for information as a root after food, and the one is as sure to obtain it as the other. If the boy is supplied with good agricultural journals, he will take an interest in them, and once interested, the chances of his leaving the farm are very much decreased; on the other hand, compel him to obtain his knowledge and information from the average periodicals of the day and the chances of his leaving the farm are at a maximum.

If asked to name the two causes which drive most of the boys from the farm, we would suggest poor tools and improper reading matter. Both of these are within and under the control of the parent, and if properly attended to will do much to solve the problem.

LAMP-LIGHT.

By R. M. STREETER, *Superintendent of Schools, Titusville, Pa.*

There are farmers, and farmers. The difference between them is wide, and due mostly to the use each makes of his lamp-light. By the lamp-light every farmer reads. From the harvest field of fact, gathered into type by skilled hands, he gleans here a hint and there a thought; and these, tested upon his own acres, fill his barns and add comforts to his home. By that same lamp-light his world widens. The comforts that crown his work have taught him, if he cares to learn, that it is not all of life to live; that fat farms and all they stand for can be only the basis of something better than food and shelter and clothes; that these are of the earth, earthy; and that the life worth living is high above them all. From that same lamp as he reads and thinks, a moral light will fall; and the good things his hands have earned and the better themes his thoughts have found, will, under this last light, broaden and strengthen his manhood and round it into that perfection it is this life's aim to reach.

In this day and generation, when the printing-press rules men's minds, there is no need of saying that a farmer ought to read. To him, as to men in other life-callings, his reading is his capital; and he, like

other men, can be put down as a success, as he reads and profits by it. His own farm tells him this, if he would listen to it; for nothing in the whole range of fact is truer than this: a field will give back what it takes and no more. Give this land care; pulverize its soil; mix with it thoroughly the food it craves; add to it year by year whatever is suggested by watchfulness and thought; and that field's crops in trumpeting that man's success will also tell of the wisdom that aims at the highest farm-culture and will use the fat field as a proof of the axiom: ground gives back what it takes and no more.

Now roots and thoughts are much alike. Both work in the dark. Both to thrive must be well fed. If the soil be poor, no rich yield ripens; if it be good, nothing so impoverishes it as crop after crop without nourishment. The likeness can be carried further, but this is far enough; for it enables me to say without fear of denial, that farmers must read and think; and that their farms tell in no uncertain way what use they are making of their lamp-light.

The theory seems to be well enough; but is it practical?

A member of the John Smith family some years ago bought some land which his friends, to humor him, called a farm. When he took possession it was a sorry one. Once it might have been described as so much woodland and tilth; but now, woods and neglected cow pasture would give the best idea; for that, naturally, includes tumble-down fences and rampant bushes, smothering here a garden—or what was one—and there an orchard with its scraggy limbs lifted heavenward, as if pleading for deliverance from the invaders of its soil. The farm's one good point was its position—a gentle southern slope with the woodland, for years untouched, shielding it from the northern cold. The house, in spite of long misuse, was still staunch, while its windows were choked with hats and rags. The door-yard? Oh, its offense was rank! It smelt to heaven! Here, by heaps of mouldering chips was a pile of rotting logs. There old iron had pitched its rusty tent. Carts and sleds housed in the open air, huddled together near by. Plows and harrows, save those a-field where they had last been used, were realizing in a fence corner the decree of ashes to ashes and dust to dust, while weed and decay were alike urged on by the barnyard, pouring down upon them its golden streams. The barn—the buildings generally—were worthy of the man who believes in practical farming, whose creed forces him to make the most of day-light winter and summer, and to give up his hours of lamp-light to rest and sleep.

Of this farm, John Smith, strong in brain and muscle, and his worthy wife took possession one day in early spring. They bought this farm because they both liked farm life and because they wanted to make it their home. As the farm was cheap, they were able to pay for it; and they had money enough left to buy a horse, a cow, and a few farming tools. One more purchase he made, a number of the best books on farming which he could find, for which he paid—so it seemed to him then—"a good round sum!" With this small outfit, they crowded their way into that forlorn farm-house and went to work.

You who began farming with a limited pocket book know what John Smith went through with, and only you who have sacrificed, as he did for those precious books, can ever dream of the joy that was his, as with their help he solved the problems that met him in his daily life. To say that he was successful from the start would not be true. First years in any business are years of trial; and when the spring came round, Farmer John was behind hand. The second year was a trifle

better; but when after the third harvest his accounts gave a balance in his favor, small though it was, it was large enough to convince him that his hopes of a home were beginning to be realized. Years later, when prosperity had taken up her abode with him, he says—and you who know the early condition of that farm will catch his meaning—"As I look out of my library window to-day"—*library* window—"I see fields reddened with the lusty bloom of clover, which stands trembling in its ranks; and which I greatly fear will be doubled on its knees with the first rain-storm; another shows the yellowish waving green of full-grown rye, swaying and dimpling, and drifting as the idle winds will; another is half in barley half in oats—a bristling green beard upon the first, the oats flinging out their fleecy, feathery tufts of blossom; upon another field are deep dark lines, beneath which in September there are hopes of harvesting a thousand bushels of potatoes; yet another shows fine lines of growing corn, and a brown area, where a closer look would reveal the delicate growth of fresh starting carrots and mangel. All the rest in waving grass; not so clean as could be wished, for I see tawny stains of blossoming sorrel, and fields whitened like a sheet with daisies; but still well enough for you to say to your hearers that this great change upon my farm is due to that book investment made long ago."

This is one instance. There are others like it; and it and they, if they prove anything, show that there are farmers and farmers; and that the difference between them is due, mostly, to the use each makes of his lamp-light.

The lamp that lightens the way to such a harvest-home does not go out as soon as the journey is done. Burning still, it shows the farmer that there are other roads than that to market; and he, sure now of his dinner, takes time to ask whither they lead. The answer is not long in coming; nor he backward in entering these strange highways. By his evening lamp, the novel leads him into the delightful paths of fiction. Here travel charms him, and without discomfort he wanders "the wide world o'er." Now history turns for him her record of great deeds; and by and by the poets begin to sing. To-night he cuts the leaves of the last "Harper;" to-morrow night the "Century" chains him to his chair; while the newspaper, in daily and weekly round, keeps him familiar with the doings of the day.

These silent speakers are not unheeded. No ear can hear them and be unmoved; and under their healthy influence the farm and farm-house bud and blossom in beauty. Nor does the good work stop here. Home, especially in the country, means the neighborhood. It takes in the school-house and the church; and the lamp-light that brings these within the circle of the farmer's vision widens, indeed, his world.

It has been easy to write this, it was easier to think it; but as your thought and mine grasp all that it means, is it quite so easy to make it real? Men in town, plagued in summer and winter alike by business, throw a halo of glory over the life of the farmer and sigh for his chance to read and study in the calm and peace of a country home. The only fact to check the sigh and to mar the picture is that their chance is as good as his. Every man who amounts to anything, and who is bound to be "fit for more than the thing he is now doing," will be sure to find a chance, or make it, for reading and study—a statement applying no more to the farmer than to the oil-dealer or the shoemaker. There is the winter, of course, when field work cannot go on;

but is it easy or is it natural for the busy, active farmer to turn to books while there are a thousand things that he likes to do calling for his care? To men shut up in the city, sweet pictures come of "green grass growing" and of limpid brooks; but are these pictures less dear to the poor fellow, stowing away hay in the stifling air under the hot barn roof? They long for that blissful time, when free from care, they are to read themselves to sleep in the hammock under the elms. Why not instead long for that blissful time, when free from care, they can turn the grindstone "under the shady chestnut tree" for the merry hay-makers to give a keen edge to their long, new scythes? They can find no time to study, busy as they are from morning until night; but would they find more time or feel more like study at night if they had been picking stones all day, or plowing among rocks all day, or digging potatoes all day?

There is but one answer to this: Farmers are like the rest of the bread-winning world. They have a chance to take things easy, and they take it. The alertness, the vim that catches a progressive idea and holds on to it, is as rare on the farm as it is anywhere else. Hear this:

"A few years ago the superintendent of the largest most progressive machine-shops in New England, who had never harnessed a horse in his life, who absolutely knew nothing of farming, lost his position. The result is, that he is to-day a successful farmer and raiser of fancy stock on a two-hundred-acre farm in the West. And he is successful, too. The past season he gathered over one hundred and eighty loads of hay, nearly five hundred bushels of oats, fourteen hundred bushels of corn, and increased the value of his stock materially. He and his boys this winter are caring for their sixty head of stock, besides horses, hogs, fowls, etc., without extra help, and the boys are all at school. This man is a great reader, and has a fine library, especially in the best departments of English literature."

I know other cases, and so do you; and all of them strengthen the theory that a farmer can read and think if he will.

Grant that he does; what then? This: The bars that fence him in are taken down and he becomes at once a citizen of the world. The telegraph brings bad farm news from Australia, and he shows his brotherhood by his keen regret. The great West is jubilant over abundant harvests, and the joy he feels discovers that "one touch of nature that makes the whole world kin." Has science wrung from the unknown another secret? Who understands it better, and who, if it falls within his province, will give it a fairer test than the farmer who reads? Has the astronomer, raking the sky with his telescope, found another star? Who is surer than the farmer to see it, when it comes within the naked eye's field of vision? Has the chemist, at home or abroad, compounded a new fertilizer? Be not surprised when my farmer shows how it works with him. Will you venture to pity the isolation of the farm-house and suggest your favorite authors for the long winter evenings? Then when your task is done, receive with as good a grace the list he gives for your long winter evenings to you. Have you read Bacon? So has he. Does he like Addison? That is a truism, and his answer is a smile. Does he enjoy Thackeray? Dickens is better. Does he care for poetry? Into his life is twisted the honest, homespun verse of Whittier, and he tells you so. Shakespeare? you ask; and he for answer, Bible?

Thus with science; thus with literature; and so we shall find him

no stranger to the language that art makes use of to express her graceful thoughts; no more so at all events than you or I, a fact that will make us cautious of aiming in his direction our shafts of criticism.

It would be pleasant to go on with this and watch its effect upon the common life of the farm; but the only fact it would make more apparent is what was claimed at the outset: the farmer's lamp-light, well used, widens his world.

I have said that the same lamp which fills a farmer's barns and makes him a citizen of the world sheds upon his life a *moral* light, if he reads and thinks. I say so now. It is a conclusion that follows with the certainty of logic. It is logic. Physical life and its needs first—they are the blade; then mind and its fostering food—they are the ear; and after that the full corn in the ear, whether we speak of matter or mind. The full corn, however, while it depends upon the blade and the ear for its support, must have the sunshine—the something higher to ripen it into corn, and the mind as it nears perfection will show, as it matures, the golden touch of heaven. Now literature understands this and makes use of it; and so far as I can judge of her work, she has been successful only when she brings out clearly some attribute of God.

Suppose she speaks of plowshares; does this attribute show itself? It does. She is writing of the useful. Its end and aim is the good,—an attribute which in its purity belongs alone to God. She goes into the workshop of science, and jots in crisp, sharp Saxon what she sees; yes, and that crisp, sharp Saxon in that search for truth pushes her from effect to cause until, by the help of Hugh Miller's hammer, she gazes reverently upon "*The Foot-prints of the Creator*." She puts her pen between the infidel fingers of Gibbon, and in spite of him it traces link by link in the chain of events the *Thou shalt* and *Thou shalt not* of Him whose "years shall have no end." The novelist writes, but he must preach to be successful; and even the genius by whose grave the gentle Avon ripples was forced to the Bible for his themes. I do not believe that that *Te Deum* which blind old Homer sung would hardly command the interest of the modern scholar, if the poet had been less pious or if the deities had taken minor parts in that sacred Grecian song. I do not believe that the echoes of time would have repeated quite so lovingly along the corridor of years the poem which crowned the Golden Age of Augustus, if Virgil had failed to baptize his verse in the religious theory of his time; and while all that Milton has left bears the seal of immortality, the sublime in literature, in my opinion, would never have reached its culmination from the inspiration of his pen had he not sung:

"Of man's first disobedience, * * *
With loss of Eden, till one greater Man
Restore us, and regain the blissful seat."

Now these divine attributes permeate all literature, and they who read thoughtfully are like the meal in which the leaven was hid till the whole was leavened.

Experience proves this every day, and nowhere more plainly or more pleasantly than on the farm, where individual thought in its amplest expression has less to encounter. Compare the farm and farm-house now with what it was that day John Smith and his wife moved in. They read and thought, and worked to realize the ideas so gained; and the fertile acres repeated those ideas to every passer-by. They read and thought, and the home blossomed into beauty as

a result. Sometimes a vine clambered up the pillars of the porch, and with its delicate tracery of leaves expressed the beautiful thought. Sometimes a hard-earned piece of furniture added grace to the unattractive rooms until, as time went by, all that grace in form, or color, or sound can offer transformed the ugly house of long ago into the real home of to-day.

What such a home does for humanity I need not undertake to tell. This much I claim: he who lives surrounded by these wholesome influences—by books, and pictures, and music, and by friends who love them and him—will find his manhood broadening, and strengthening, and rounding into that perfection it is this life's aim to reach.

I guess—it is my Yankee birthright—that more than one of you before me were born and bred upon a farm. I guess your eyes as well as mine have seen at the old home how lamp-light, rightly used, has added acres to the homestead and made them fertile. As crops grew large and comforts came, you thought with all of us that things to eat and wear were good, but that better were beyond; and so when thought found voice, and great men came in books to tell us stories, talk to us, read us poems, sing us songs, and we, catching bright glimpses from them of the far-off world, made up our minds to see what we had heard of, the morning came for us to go away. Like a dream that morning comes to us to-night. There is the early breakfast, the bustle of departure, the glad and the sad good-bye, the rattle of wheels, and home is left behind. Do you remember the rising in your throat, when, at the bend in the road which hid the house from view, you turned for one last look; and how through the gray of the morning the lamp-light sent streaming across the field its blessing and farewell? That lamp-light has never gone out. We can see it burning still; and when we remember that all we are and all we can ever hope to be here or hereafter is due to that flickering flame, with a feeling akin to awe we exclaim: "How far that little candle throws its beams!"

UNDERDRAINING.

By DAVID EMERY, of *Titusville*.

There never was an era in the history of agriculture, especially in this county, that is calling forth the scientific and experimental ideas of the people in devising the best methods of tilling and improving the soil, the cheapening and lessening of the labor of the farmer, as the present.

Experimental work is being carried on by the Department of Agriculture of both the National and State Governments, and with marked success. The results, as far as possible, are being heralded throughout the country.

While these investigations have been carried forward, the agricultural interests have been correspondingly benefited, and the farmer who was skeptical regarding the philosophy of the science as applied to the soil, is becoming converted to its principles.

Every year brings forward new difficulties for the farmer to contend against, and the older our farms become will they increase.

These questions must be met by each one, and the solution becomes valuable in the light of the results obtained.

The person who chooses agriculture as a calling and occupation, must, as far as possible, strive to make it financially successful, and, as much as in him lies, do his share toward opening up the great secrets which are embodied in the works of nature.

Other generations have stood in the same furrows which we to-day turn back and forth upon our lands.

In many cases, they fail to produce as profitably as they did in yester olden time. The present resources of the soil which nature has provided have been so crippled or put in such a condition that they fail to respond generously to the tiller's labor.

We call the halt to devise means to restore the soil to its former fertility and profitableness.

First, the study of the soil commences, and we find sandy and gravelly soils need only good tillage and plenty of good fertilizers, and they will produce abundantly, nature having produced perfect filtration or sub-soil drainage.

Clay loams require drainage and an abundance of phosphates to cleanse and enrich the soil.

All these devices are questions for each one to decide for himself. One of the great questions which has occupied my attention for a few years past, in a limited way, is that of underdraining, yet I feel my inability to discuss the subject with that skill it deserves, my knowledge coming only from such practical tests as I have applied to my farms, and a hasty study of the subject from prominent authors.

Underdraining seems to be of great antiquity, being noted in the early history of agriculture, and for several centuries it has been a prominent question with the British and American husbandry.

The first essay on this subject was written in England two hundred years ago, recommending deep ditches as "a preventive to the accumulation of superfluous and venomous water," this being followed by others making a more thorough investigation of the subject, the result of which is our modern system.

The first question which arises in my mind is, How am I to decide that my land, or any part of it, needs underdraining?

If you find clay-loam fields, where vegetation is more backward than upon other lands, the soil tough, hard, indurated, and inclined to crack on the surface in dry weather, water settling in the furrows while plowing, or in depressions, or if clover shows signs of throwing out its roots in the early spring months, or your land shows ice mounds, or a soil that is not ready for tillage very soon after the frost leaves the ground, the above conditions indicate that your land needs underdraining.

A prominent author on underdraining says that, as a rule, all lands, of whatever kind or character, in which the spaces between the particles of soil are filled with stagnant water to that depth where the roots of ordinary crops reach, in which there is not a free outlet for all the water it receives from the heavens, or from any adjoining lands, or from any springs, are not conducive to fertility and profitable farming; that the particles of the soil should be moist, and surrounded by air, and not water; and further says that a drain dug to a proper depth through a field draws away the surplus water, leaving in its place air, while the particles of soil hold the moisture by attraction, leaving the surface porous and healthy.

Briefly let us look at the requisites for plant-germination:

Air, warmth, and moisture; these three must be in the soil in their

proper proportions, and, whenever there is excess of either, germination is retarded, and especially if the excess be in the moisture; and where such is the case, air is excluded and the temperature lowered. The soil being wet, the spaces are filled with water instead of air; the moisture being too near the surface, evaporation takes place, causing a lowering of the temperature, while, if the soil were in a proper condition by natural or artificial drainage, the germ elements could assert their power and produce a healthy growth.

The most productive results are brought about by the soil being in such a proper condition that all the benefits intended by Providence in the rain-fall may be obtained.

There are in the rain that descends upon the earth chemical properties of inestimable value to plant-growth and productive vegetation.

These elements must be appropriated by a perfect filtration, and that can only take place when, by natural or artificial drainage, the water-line, or the level at which the water stands in the soil, has been brought below that point necessary to be drained to secure a healthy growth. When such is the case, and these conditions are fully complied with, the elements are taken up by the feeders and transmitted to the plant, producing a normal growth, otherwise the properties which the land contains are lost by evaporation, besides leaving the surface of the soil in a worthless and indurated condition.

It is a conceded fact that the sandy and gravelly soils are the first in bringing forward spring or early crops, while the clay loams, which are classed among wet soils, are cold and late.

Our best authorities give this explanation: An excess of water in soils reduces the temperature by evaporation. Stagnant water conveys no heat downward, although the surface is warm, these portions thus heated, being lighter, remain on the surface, giving back their heat to the atmosphere, and not downward in the soil. Upon the foregoing principle, we can readily see why the fibrous roots of plants fail to push downward in undrained soils, these being imperfectly nourished, and producing only a sickly growth, followed by an almost worthless crop.

Prof. F. A. Allen, of Tioga county, in a very able paper on this subject, read before the State Board of Agriculture in 1879, presented the following obvious results arising from draining:

First. It carries off stagnant water, and furnishes an escape for excessive rain-fall.

Second. It prevents the ascent of water from below by capillary attraction.

Third. Water passing downward through the soil opens the way for fresh air, laden with oxygen, which is so essential to hasten the decomposing of minerals in the soil.

Fourth. Soils, after draining, become more open and pliable, and thus more easily tilled.

Fifth. Soils become warmer by taking off the water, and thus advance or hasten their growing crops, bringing about an earlier harvest, and, in effect, producing a change in climate.

Sixth. It enables the farmer, in wet seasons, to hasten the spring and fall seeding.

Seventh. It increases the depth of cultivated soils.

Eighth. In wet soils, wood-ashes, bones, and many other ingredients that might act as fertilizers, lie dormant and are lost. Taking off their

excessive moisture by draining, these elements are changed and rendered effective.

The several propositions of the learned gentleman have been demonstrated by actual experience to be correct, and contain obvious reasons to prove that underdraining should become more general.

There are still other important points in connection with this subject which have not been treated by many writers. One of the most vital is the health of live stock. It has been demonstrated that the percentage of loss is greater upon the heavy, undrained soils, than upon drained lands. Physiological investigations reveal the fact that many diseases of farm animals are attributable to a vegetable parasite nurtured and matured upon the stunted vegetation of undrained and worn-out soils.

It is a common occurrence among farmers to put in pasturage the worn-out and soggy lands, a practice both dangerous to the health and unprofitable to the growth of such live stock as may be forced to obtain a subsistence therein. Such fields are infested by poisonous weeds which breed and nourish parasites known to be both injurious and fatal to animal life. The grasses indigenous to this description of land are tough, wiry, and contain, in a small degree, the elements necessary to animal life and growth. Underdraining will eliminate them, and good succulent grasses, free from parasites, will take their place.

It is a conceded fact that a sandy or gravelly soil or a well underdrained clay loam will carry a crop through a long drought with far better results than a tenacious subsoil will. Why? The pressure of the air is fifteen pounds to each square inch, and if the soil is open and porous, as it is upon the soils alluded to, the air in the night, when dew-laden, will permeate every tiny crevice and pore, and deposit its moisture by condensation. A compact soil in a period of drought gains no moisture by condensation, and plant-growth is at a standstill. Above all things, underdraining should be secured all about the house as a means of preventing sickness. At all times there is more or less decaying vegetable matter. If the rainfall or the dew deposit cannot permeate the soil, but must be dried up by the sun, a malarial exhalation is the result, vitiating the air we breathe, oftentimes being the cause of many of the ills that flesh is heir to. It has been demonstrated by experiment that by giving free drainage to water in cold soils, it raises the temperature ten degrees above that of adjoining lands of the same quality, thus enabling tillage two weeks earlier and retaining its increased heat two weeks later in the autumn months, consequently the spring crops come to full maturity. One of the difficulties we experience in this climate is the uncertainty of spring crops, which difficulty could be obviated by a thorough system of drainage.

It is, perhaps, difficult to make mathematical calculations of the work that the atmosphere must accomplish by evaporation in soils where there is no natural drainage. We will suppose the annual rainfall is twenty-eight inches; then there must be evaporated two inches and one third per month during the year; and if this be true, it is obvious why we are not successful in the production of many crops which have been nearly, if not quite, abandoned on account of the unmatured and meager yield. The reasons are, as we have already shown, that evaporation diminishes temperature, and perfect filtration or drainage increases it. The question naturally presents itself, how shall we lay out a system of drainage? My experience has been limited, and I can only say, that every farmer must be his own judge from his acquaint-

ance with the field upon which he must operate. I began underdraining seven years ago and it has been quite successful, and upon the land we raise all kinds of grain, which ripens in the proper season.

My manner of draining is to dig a ditch twenty-eight inches deep and as narrow as can be conveniently dug, and place therein flat stones about fourteen inches high, placed side by side edgewise as close together as possible, to prevent mice, crabs, etc., getting between the stones and frustrating the design. *i. e.*, the flow of water, and I am inclined to believe that in this method, which causes several streams to be running all the time through small apertures, the drain is less liable to become filled up with sediment. I then put another tier of stones in same manner upon the other tier, taking care to break the line or fit the top stones into the opening of the bottom, and upon them a layer of straw; then filling the ditch to within six inches of the top of the ground.

It does not appear reasonable that, having the stones packed so closely together, water will go through the drains at all, but the best proof I can present is the fact that any time a stream of water can be seen coming from the outlet of the drain, and after a rainfall in a short space of time the stream is increased, showing beyond doubt that the water is flowing through and finding its way along the drain. I give this as the method I have used, and do not pretend to claim that it is superior to any other system.

I have had the best success by digging my drains diagonally across the hill one hundred feet apart, the advantage gained being the cutting off of any spring, and preventing its running over the land. Another way is to put one large main drain up and down the hill, running the laterals or side drains diagonally into it, both of which are successful, and up to the present time seem to work as successfully as when put in. Every man must be governed by the condition and contour of his land in deciding upon a plan for draining it, and as this is very important, I advise that great care should be given to the subject that you may be able to thoroughly drain the largest amount of land with the least possible cost.

I would add that I put drains under all my board fences, putting the post into the drain, which prevents them heaving out in the spring, thus making the drain serve two purposes.

The best authorities on draining recommend tile pipe, giving as a reason that it is the only sure and perfect manner, obviating many difficulties likely to arise in stone drains. I do not recommend the use of stone unless they are flat, and great care be taken in placing them close together, upon which depends the entire success of this system. In eastern Pennsylvania many farmers adopt this successfully.

I would urge the necessity of thorough work in the construction of drains, whether they be tile or stone, as we cannot afford to reconstruct, as we must, poorly made and imperfect drains.

It is beyond a question of doubt that great profits accrue from drainage, and many instances are cited in books of reference of wonderful results.

Mr. Johnson, the pioneer of tile-draining, says that draining will pay for itself in two years, and so convinced was he of the advantages accruing from it that he made the statement that he would not hesitate to borrow money with which to drain, and further states that he never made any money until he commenced draining.

Agricultural pursuits are being changed from mere drudgery to profit and pleasure, and it only needs larger scientific researches to accomplish the desired results, to place the soil-tillers on an equal footing with any other business men.

THE KIND OF FARMING ADAPTED TO OUR VICINITY.

By Hon. W. B. BENEDICT, *Enterprise, Pa.*

It is a matter of great importance to agriculturists that they carefully study their soil and climate, that they may be qualified to judge intelligently of what is to them an essential element to their success. Have we, members of the Oil Creek Valley Agricultural Association, made the question of adaptability of soil and climate for certain kinds of farming a thoughtful one? Have we carefully studied to what products our soil is best adapted to insure us a profit for our capital and labor?

Have not some of us been fighting old Dame Nature for many years by attempting to raise crops for which neither soil or climate are adapted, and have not some of us been badly worsted in the combat? And after defeat, has there not been much growling and grumbling and fault-finding, attributing all failures and mishaps and disappointments to the dear old dame? This class of farmers continues in the same way, year after year, and acquire no wisdom by experience. Experience is said to be a good but expensive teacher, but some farmers will not profit by the teacher, even if the tuition is free. That class of men remind me of the log-chopper's dog, with whose exploit and sad ending no doubt many of you are familiar. They won't see anything until they are smashed by their own heedlessness. It does seem that this class of farmers would learn what crops or stock succeeded best in their vicinity, and be governed in selections and cultivation by the experience of their neighbors, if their own has availed them nothing. To those who have thoughtfully and wisely observed, it is indisputably the fact that this vicinity is peculiarly adapted to the growth of grasses. Our native grasses are white clover, red-top, and June grass; all of which grow spontaneously wherever the rays of the sun penetrate. Each of these natural grasses is very nutritious, and furnishes the best of pasturage. How frequently we hear it remarked that young cattle running in the woods and highways become fat much earlier in the season than those inclosed in pastures. This is a fact, and the reason for it is, that they have access to these succulent and nourishing grasses in all their freshness and sweetness, as they grow by the side of the cool, shaded brooks, and in the wooded openings where once waved the towering plumes of the original monarchs of the forest, which had been removed by the axeman, who did not spare. Our section of the country is naturally adapted to the growth of grasses. There are no better grass lands, outside of the blue-grass regions of Kentucky than those of this locality. Timothy and clover can be, and indeed are, grown here equal to that of any locality in the continent. Then, with a country ordained by nature for a particular kind of agriculture, with a natural soil and climate adapted to the growth of all the superior

ance with the field upon which he must operate. I began underdraining seven years ago and it has been quite successful, and upon the land we raise all kinds of grain, which ripens in the proper season.

My manner of draining is to dig a ditch twenty-eight inches deep and as narrow as can be conveniently dug, and place therein flat stones about fourteen inches high, placed side by side edgewise as close together as possible, to prevent mice, crabs, etc., getting between the stones and frustrating the design. *i. e.*, the flow of water, and I am inclined to believe that in this method, which causes several streams to be running all the time through small apertures, the drain is less liable to become filled up with sediment. I then put another tier of stones in same manner upon the other tier, taking care to break the line or fit the top stones into the opening of the bottom, and upon them a layer of straw; then filling the ditch to within six inches of the top of the ground.

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grasses that cannot be excelled for pasturage and fodder, why should we not utilize this lavish gift of nature's hand to our profit and comfort, and to the material advancement of our loved country? The plow is an important and useful implement of agriculture, but in our cold, clay soil it must be used with judgment, tempered with a goodly supply of discretion.

"Too much plow" has been the bane of many a farmer in this locality, and we have many striking examples of this in the worn-out and impoverished farms of many of our early settlers. Our lands, once well and richly seeded with grass, can be kept in fertile meadows as long as man lives to attend them, by frequent top-dressing with the proper manures.

I firmly believe that a great and serious mistake has been and is being made every year, by trying to produce certain grains for which the soil or climate of this vicinity is very far from being adapted; for instance, wheat and corn. How much profit is there in growing these grains in this section? To be sure, once in a while, a man who has fertilized liberally and heavily, in an exceptionally favorable season, will get a fair crop of one or both of these cereals; but how much more frequently he fails to secure a paying crop of either. The same amount of fertilizing and labor will bring more money in grass, five years out of six.

We have a country especially adapted for grazing. If I can read the signs of nature correctly, she would have us devote our energies and labor to the proper utilization of our grasses. She would have us cover our hills and valleys with flocks and herds, and by so doing partially compensate her for her generosity. Our country is among the best watered ones of the world. Sweet, soft water flowing from almost every crevice in the rocks, as pure as the air, and as cold as if from an Arctic fountain, added to the rich and nutritious grasses, gives me a strong and firm impression that we have a section that has superior advantages for a first-class dairy country. Why not so? Is there any other locality better adapted for dairying than ours? Have Herkimer, Onondaga, or Chautauqua counties, of New York, any better grasses or water than ours? Have Chester or Montgomery counties of our own State any superior advantages for dairies to those of ours, except that of market facilities? Dairy farming or stock-raising does not deplete and impoverish our soil as does grain-raising, or grass-growing either, where all is sold off the farm and nothing returned to the land for compensation.

I hope to live to see the day when, in our valleys and hill tops, there will be creameries and cheese factories by the score, and dairy farmers enough to amply supply them with pure and unadulterated milk made from the sweet and juicy grasses that grow in their vicinity.

Sheep-raising can be made a profitable part of our agriculture, and should be an important part of our stock-raising, for our lands are high and dry, with a good pasturage, and a home market for our wool and mutton.

Those who have a love for the most noble of all domesticated animals—the horse—can breed them here with a profit, if they pay proper attention to business, and use care and discretion in selecting their sires and dams, which is essential in the breeding of all live stock. It is a source of great satisfaction to me to observe the marked improvement that has been made, during the last decade, in the live stock of our section, and I am firmly convinced that the thoughtful and intelli-

gent part of our farmers will agree with me when I say that our section is well adapted to stock-raising and dairying, and those that have been, and are, engaged in either of the two occupations will bear me witness that their farms have improved under these two departments, and that those farmers who have grown grain exclusively have impoverished their land, with only a few exceptions of a number—not many, however—who have been so highly favored as to have easy access to the barnyards of the citizens of Titusville. I would not be understood as recommending the abandonment of all grain-growing in this vicinity, but I would have all farmers study what they can, and do, grow to a profit. Oats do well upon our soil, if properly sown and cared for. So do buckwheat and potatoes. All of the vegetables that are incident to this latitude do well here, and many of them are cultivated and grown to a profit. What I would have the farmers of this vicinity do, is to study the component parts of their soil, and, by so doing, learn what part or branch of agriculture their own farms are best adapted to, and I would also have them *analyze themselves* as well as the soils, for unless they adapt themselves to their avocation, they have failed to obey that oft-repeated proverb, "Man, know thyself."

ROAD-MAKING.

By A. M. FULLER, of Meadville, Pa.

There are few questions, at the present time, of greater importance, or which claim more earnest attention from all progressive citizens, than that of road-making.

The farmer no longer conducts his labor without the aid of improved machinery and farm implements. In the construction and maintenance of our highways, however, there has been little improvement; the old methods still prevail, and the fact that there is machinery as much superior to the ordinary plow and scraper for road-making as the mowing machine is superior to the scythe in farming operations, is a fact not as well known as it should be. Road-making may properly be divided into three stages of development.

First. The location of a highway wherever the needs of the public may seem to demand it, to be followed by the opening of rude ditches along its sides, and the construction of the necessary bridges and culverts.

Second. The construction of a road-bed of the requisite width, which shall present a convex surface extending to the lowest point of the ditches on both sides, thereby affording good drainage, and which may be considered a finished dirt road.

Third. The covering of a properly constructed dirt road to a suitable depth with material that will hold the road in shape and present, at all times, a smooth, durable surface.

In this country, we have made but little advance beyond the first stage of development, viz: the opening of highways, but imperfectly drained by rude ditches, and the construction of the necessary culverts and bridges. Before discussing the advantages of what may be called the second stage of development in road-making, it might be well to consider the common defects of our present system.

The defects most prominent in our present system (if it is worthy of being called a system) of road-making is in rounding up the road-bed so that teams necessarily pass on the summit, and cut the way into ruts and ridges, which retain the water. The first heavy rain produces mud-holes and a broken surface, rendering the road nearly impassable. Each year the same remedy is applied, a quantity of dirt is plowed and scraped from the ditches, and ridged upon the driveway. The body of the road thus becomes from six inches to two feet higher in the center than at the sides, and except in the best of weather there is never good driving. Again, the road-beds are generally too narrow. The results which follow are the same as when the center of the road is too high; travel being limited to one track soon produces deep ruts.

The driveway should not be less than twenty feet in width on our main roads, with a slight descent from the center to the ditches. Such a road will not be readily graded at first, but in the end will pay for all the labor expended in its construction.

Another glaring fault in our present system is the custom of expending all the road tax at one time instead of distributing it throughout the year. Too frequently the "pathmaster" is not competent to direct the work; the prevailing shiftless manner of repairing roads makes no advancement beyond the first stage of road-making.

The interest which is being taken in improved methods of building roads, not only in this section, but throughout the country, augurs well for the future. In many parts of the country through, the adoption of road machinery, rapid progress is better made, and better roads are the result. The second stage of development in road-making, viz: The construction of a road-bed of the requisite width which shall present a convex surface extending to the lowest point of the ditches on both sides will next claim our attention.

In order to secure a driveway of twenty feet in width of suitable grade from ditch to ditch, will require in the present condition of our roads the removal of a great amount of earth. Our roads are now confined mainly to one track, which frequently is lower than the sides of the road, furnishing in many cases an additional ditch to the road. It is necessary, in order to widen the road, to remove the shoulders of earth or sod which line the road on either side. As these are frequently from two to four feet wide, this cannot be done economically with the ordinary plow and scraper. It requires the use of a road machine to do it properly and economically. On an ordinary road two men with one machine, drawn by four to six horses, will construct from one half to one mile per day, the surface of which will be perfectly smooth, and the width of sixteen to twenty feet, and in no other way can it be done so well or so cheaply.

Road machines are a recent invention. The perfection of the machines and their adaptability to the work is simply surprising. It matters not how hilly or stony the ground may be, they can be employed in any place where a plow can be used to advantage. The machines are very durable, and of great power in the removal and carrying of earth, and are not more trying to the team than working with an ordinary plow and scraper.

The best machines are undoubtedly the Pennock Victor Reversible, manufactured by S. Pennock & Sons' Co., Kennett Square, Pa., and the Improved Champion Reversible, made by Geo. W. Taft, Abington, Conn. The Waldo, Pennock Improved, Moore, Lamborne, Fleming & Boss, are all capable of doing good work, but for all kinds of work

required on the road the reversible machine is preferable, especially in a hilly country. The cost of the reversible machine is from \$210 to \$250, and the straight bar machine from \$85 to \$150 for two and four-wheeled machines. Under the present tax levy for road purposes, townships should collect cash all the law will permit, and secure road machines to take the place of the plow and scraper in working the roads. There should be at least four machines in every township. The effort to introduce machines in this section last season was quite successful, and all who witnessed the working of the machines admit that it is the best and most economical way of improving the roads. It is in no sense an experiment. Road machinery will accomplish at least four times as much work, and infinitely better work for the same expenditure of labor, than by the old method, and will certainly supersede the old way, and prove as necessary in the road-making of the future as the mowing machine at present is considered superior to the scythe and deemed a necessity in farming operations.

The third and final stage of progressive road improvement, viz; the covering of a properly constructed dirt-road with material that will hold the road in shape, and present at all times a smooth, durable surface, affords an interesting study, and demands more time than I can claim in a short address on road-making. By the proper use of road machinery, a solid and perfect road-bed is formed. We have not yet, however, a substantial road. Sand and gravel alone will not make a good road, even if placed in the best form and supplied with good drainage. Gravel or broken stone must be used to form an impervious and durable surface.

A mistake is frequently made in supposing that gravel of *any kind* will answer to make a good road. Such is not the case. Gravel obtained from the beds of streams is sedimentary in its nature, and after being in use for a short time, crumbles and becomes mud. Where good sharp gravel can be obtained for roads, crushed stone is not necessary. One load of crushed stone, however, is estimated to be equivalent to four loads of best gravel for road construction. It is also a mistake to suppose that a great depth of gravel or crushed stone is necessary in order to make a good road. If the road-bed is in proper shape to receive the material, three inches of gravel placed upon the road, and when well compacted, followed by three inches more, is better than six inches at one time. In this connection it may be interesting to refer to the "Macadam system," which is generally acknowledged to be the most perfect system of road-making. Macadam's plan of road-making differed very much from the old way.

Instead of going deep for a "bottoming," he worked solely on the top. Instead of producing a peaked, roof-like mass of rough soft rubbish, he got a flat, smooth, and solid surface. In lieu of a road four feet and a half through, he made one of at most ten inches in thickness, and for rocks and boulders he substituted stone broken small. The principle upon which his system was founded was that a road ought to be considered as an artificial flooring, so strong and even as to let the heaviest vehicle pass over it without impediment. He built roads thirty and forty feet wide, rising only three inches in the center, and contended that a more lasting road could be made over the naked surface of a morass than over solid rock.

Another of his easy first principles was that the native soil was more resistant when dry than when wet, and that, as in reality it had to carry not only the traffic but the road also, it ought to be kept in

the condition of the greatest resistance; that the best way of keeping it dry was to put over it a covering impervious to rain, and that the thickness of this covering was to be regulated solely in relation to its imperviousness, and not at all as to its bearing of weights to which the native soil was quite equal. Instead of digging a trench, therefore, to do away with the surface of the native soil, he carefully respected it, and raised his road sufficiently above it to let the water run off. Impermeability he obtained by the practical discovery that stone broken small and shaken and pressed together as by the traffic on a road, rapidly settled down face to face and angle to angle, and made as close a mass as a wall. Roads which were mere layers of broken stone, six, four, and even as light as three inches in thickness, passed through the worst winters without breaking up. The size to which the stone should be broken he determined in a practical way by the area of a ordinary wheel with smooth road. This he found to be about an inch lengthwise, and, therefore, he laid it down that "a stone which exceeds one inch in any of its dimensions is mischievous," that is to say, that the wheel in passing on one end of it tends to lift the other end out of the road. He would allow no larger stone even for the foundation of his road, for he found that they constantly worked upward, by the pressure and vibration of the traffic. The whole road was small broken stone, even over swampy ground.

The foregoing sketch of the Macadam system of road construction, while it may seem to apply more especially to cities and towns, contains much that is of value in ordinary highway repairs.

We have very briefly discussed the three stages of development in road-making.

It will be readily admitted, I think, that in many parts of the country we have scarcely more than entered upon the second stage of development.

It is possible, with road machinery under our present system, to accomplish much, but the full measure of success in road-making can never be attained until a *cash system* of road tax is adopted, and the work is done systematically, intelligently, and thoroughly.

THE PENNSYLVANIA STATE BOARD OF AGRICULTURE.

WHAT IT IS, AND WHAT IT HAS DONE.

By THOMAS J. EDGE, *Secretary*.

The Pennsylvania State Board of Agriculture is, to all intents and purposes, a full and independent department of the State Government; it is subject to no other department, and is free and independent in its action, being only limited by the act which created it; it was not made a full department, for in that form its executive officer would have been subject to political appointment and preference; the whole machinery of the Board would have been still further removed from the farmers of the State, instead of being controlled by elected members, as at present.

Its members are, by law, divided into three classes, which, however, only differ in the manner in which they secure their membership. The

first, or *ex-officio* members, are fixed by the law creating the Board, and are the Governor, Secretary of Internal Affairs, Superintendent of Public Instruction, Auditor General, and President of the State College.

The second class consists of three members, one of whom is annually appointed by the Governor and Senate, and who holds office for a term of three years.

The third class consists of members elected by such county agricultural societies as are by law entitled to an annual bounty from the county. Of this class there are forty-four, and it is believed that every county society in the State entitled to elect a member is thus presented in the Board, thereby demonstrating their appreciation of its value and usefulness. In many counties the election of the representative in the Board of Agriculture causes as much interest and competition as that of any officer of the Society.

The executive officer of the Board is its Secretary, who is elected each year by a vote of the members at their annual meeting at the State Capitol.

The amount at present appropriated by the Legislature for the use of the Board is five thousand dollars per annum, which is specifically appropriated as follows: For the actual necessary traveling expenses of the members, fifteen hundred dollars; for the actual expenses of holding county and local institutes, fifteen hundred dollars; for the salary of the Secretary, fifteen hundred dollars; for postage, janitor's salary, express charges, and other office expenses, two hundred and fifty dollars, and for the investigation of diseases among domestic animals, two hundred and fifty dollars.

Some of these items it is not proper for me here to comment on, but it would seem that two hundred and fifty dollars is but a limited amount with which to look after the health of eighty-five million dollars' worth of live stock, and that the investment would warrant a larger appropriation. As it is, we venture the assertion that there is not an equal sum of money expended in any way in connection with the State Government which is as productive of good to the general taxpayer.

This, then, in men and money, is the State Board of Agriculture. Its members receive nothing for their services beyond necessary traveling expenses, and more than once, when the appropriation has been exhausted, have had to pay a portion of this from their own funds. The total expense of the Board to the taxpayers is about two and one third cents to each farm in the State.

In passing to the second branch of my topic, I, for reasons which must be apparent to all, find some difficulty in reaching a proper expression of the meaning which I wish to convey, for the work of the Board, commencing at first in a very limited way, has extended into every department of agriculture, and to every portion of the State; hence, I will only direct your attention to what I conceive to be the leading results of its work, premising that the aggregate of smaller matters which I leave untouched far exceed in value the main points touched.

The first great need which the Board supplied was a rallying point around which the other agricultural interests of the State might gather. It is true that we then had, as now, the State Agricultural Society, the State Horticultural Association, the State Dairymen's Association, and other similar and kindred organizations, all doing

good in their respective departments, but none under the control of, and responsible to, the State Government for its work and expenditures.

The first practical benefit which is apparent to the farmer who examines into the workings of the Board, is that it furnishes him with a central organization to which he may direct all inquiries, and from which he may receive information relating to his calling. The Secretary does not profess to be able to answer all questions which may be presented, but he has in the honorary officers of the Board a corps of men who are noted specialists in the callings which are subsidiary to agriculture, and some one of them is usually able to return an intelligent answer. It is with some degree of pride that the Secretary is able to state that, since the organization of the Board, no one has been turned away without as full and complete an answer as the circumstances of the case would permit.

As a bureau of information alone, the Board is worth many times its cost to the farmers of the State, and those who have given the matter but a casual thought would be surprised, not only at the number of inquiries which are annually received, but also at the wide and extended range which they take. If a farmer is in doubt as to the value of a fertilizer offered to him, a postal card directed to the office of the Board will usually bring him a printed list showing its value, as taken from a sample selected by a disinterested and sworn agent, and analyzed by one of the best and most reliable chemists in the State. The list will show him, in dollars and cents, what the fertilizer is worth to him, and from this data he can decide whether to purchase or not.

If a disease among his live stock troubles the local practitioner, he has but to send notice to the office of the Board, and, if the appropriation is not exhausted, one of the best veterinary surgeons in the State is at once sent to investigate the matter, and give such advice as may assist in saving further loss. If he is in doubt as to the name and nature of a weed, he has but to furnish a sample, and, as soon as possible, he is furnished with a full history of its nature and habits of growth. If he wants any particular kind of grain or live stock, a note addressed to the office of the Board will inform him where it is most likely to be found. Nor is this demand for general information confined to our own State; inquiries in relation to general agricultural interests in our State are received from nearly every State in the Union, and the annual reports of the Board are in demand in every State, and are considered standards of their class.

The Pennsylvania fertilizer law of 1879 is a monument of the work and value of the Board, and one to which, had it done nothing else, it may point with pride, and ask no other criterion of judgment. This act, by its application and effect, has challenged the attention of other States, and its leading features have been engrafted into the laws of a number of other States. This act, by its fair and careful enforcement, has increased the average value of the fertilizers consumed in the State fully three dollars per ton, and some of our leading fertilizer manufacturers place the increase at a still higher figure. Three dollars per ton means a saving of not less than three hundred thousand dollars to the consumers of this class of goods, or at the rate of nearly two dollars per annum to each farm in the Commonwealth; this, too, without any cost to the taxpayer, and returning fully sixty times the entire cost of the Board and its members.

The Board has also drafted, and mainly by its influence had passed, the law for the suppression of contagious pleuro-pneumonia among cattle, which, by the cordial and active coöperation of the Governor, has eradicated the disease, and driven it from its foothold in our State. During the seven years which this act has been in force, its annual cost has not exceeded one and a half cents to each farm in the State, and the total cost for the seven years is less than was expended by another State in a single year, without producing any beneficial effect. The annual saving to the live-stock interests of our State by the enforcement of this law can scarcely be estimated in dollars and cents; but, at a low estimate, exceeds ten times the total cost of the Board.

At the last session of the Legislature, the Board was granted an appropriation from which it could assist in defraying and encouraging just such meetings as this; what the result may be is yet too early to determine, but enough has been shown to demonstrate that by this mode of increasing the interest of farmers in their calling the Board may, in the future, accomplish much which will benefit the cause for which it works and for which it was created.

OBNOXIOUS WEEDS.

By H. M. CUTSHALL, *Randolph, Crawford county, Pa.*

In accordance with the expressed wishes for me to read a short paper at this meeting by the enterprising president of our agricultural association, I am here to add my mite toward the success of this farmers' institute, held in Titusville under authority of the late act of Assembly.

The subject upon which I have based my few remarks is "Obnoxious Weeds." I did not choose this subject on account of its high-sounding title; I chose it because I believe that the failure to realize a profit in agriculture can be traced to this evil to a greater extent than to any one thing in the general management of the farm and garden. Interesting subjects are on the programme for discussion at this meeting in fact, good papers are read at all meetings of our "State Board of Agriculture," "Dairymen's Association," "Farmers' Clubs," etc., all looking to a higher plane in the management of the farm.

The subjects of "How to apply barnyard manure for best results," "The use of commercial fertilizers," "Underdraining," &c., occupy the attention of the intelligent farmers who assemble at these meetings from time to time. The farmer who is awakened to the importance of underdraining sees idle marshes, and low places where surface water can be found the year round, tries the work of underdraining. After this is successfully done the plot is fitted for the crop.

These places are rich from natural deposits of decayed matter which have accumulated there for years and are hot-beds, in a sense, where grain and vegetables will make prodigious growth; but in order to reap the fruits of your labor, the watchful eye of the husbandman must see that weeds do not spring up and cut short the crop even in its last stage of development.

The use of commercial fertilizers is fast gaining headway in this section. Farmers must not forget that these fertilizers will grow "weeds" as well as grain and vegetables, and where the strength of these fer-

tilizers is taken up by weeds, the owner is the loser in more ways than one. He not only loses in the present crop, but he has by his outlay produced a crop of "obnoxious weeds," whose seeds have ripened and fallen to the earth, to come up in after-years to harass him, causing him unnecessary labor and diminishing the fertility of his soil. No farmer who does not give special care that no weeds come to maturity in his fields should expend money for fertilizers—it will be an unprofitable investment, and dissatisfaction will be the result.

Thus far we have spoken about weeds in fields under cultivation. But the care of the farmer does not end here. Meadow lands are many times infested with weeds, which add nothing to the value of the crop, and yet they are a constant drain upon the fertility of the soil. Those farmers who have meadows infested with daisies in their various forms, Canada thistles, and other weeds less obnoxious, and yet of great damage to lands as well as to the owners, seek to capture these weeds before maturity and haying is commenced early in June. This is intelligent, and seeks in a measure to curtail the spread of the same, and they can by perseverance totally annihilate such, in time. This early cutting of grass leaves weeds which start later in the season to grow and mature their seeds, which fall upon the earth awaiting the time when they can germinate and bring forth a hundred-fold. Among the most to be dreaded of late weeds is the "plantain," commonly known as the white and black. They are quick growers, and in a single season will deposit seeds to pester the husbandman for years. The common plantain, found in close proximity to every farm building, is not entirely worthless, as stock will eat the same with evident relish either in green or cured condition. It is, nevertheless, to be dreaded, and if no effort is made to check its growth, will, in a short time, be master of the situation.

We have found that fields polluted with this weed can be successfully and cheaply cleaned from the same by pasturing, as all stock is fond of the plant. Fields long under cultivation need rest, and seldom get it, because the average farmer has not yet seen the wisdom of such a course. But God intended that the hoof of the animal should come in contact with the soil, and we doubt if the productiveness of the land can be increased in any way so cheaply as by a wise course of rotation where pasture comes in for one fourth the time.

A weed known in this locality as "black plantain" is spreading rapidly. It seems to be obnoxious to stock of all kinds; it is a prolific grower, and yields an immense amount of seeds. Our farmers view it with alarm. It seems to crowd out with ease everything else, and, if not closely watched, will, ere long, be a source of great annoyance and loss to the farmer. I should much like to hear from those present concerning this weed, and what can be done to prevent its spread.

We might go on indefinitely and describe many obnoxious weeds, but in a short article like this it is not possible or wise so to do. It is enough to say that a constant warfare must be kept up against weeds, if we are to reap the benefit of our labor as farmers. It has been truly said that "eternal vigilance is the price of liberty." Eternal vigilance is the watchword if we would keep down the growth of weeds, which, if left to grow, will sap the life out of our farms, and leave us the owners of the land, minus the soil. An article on "obnoxious weeds" that did not speak of the everlasting "Canada thistle" would be shorn of half its splendor. In fact, any agricultural association or assembly of farmers that did not discuss this question, and resolute against it,

would be considered a tame affair. It would be like the play of Hamlet with Hamlet left out. It is well that it is so. The prevention of the spread of this plant or weed has been discussed for years. Legislatures have enacted laws whereby township officers have been given power to enter upon the lands of others and destroy the thistle, and receive compensation for so doing. An act of the last Legislature provides that a fine of fifteen dollars shall be imposed upon the owner of lands who allows the Canada thistle to seed; of this sum one half goes to the informer. Of course these laws are intended for those who willfully or carelessly allow these pests to mature. All enterprising farmers will see that the spread of this plant is curtailed as much as possible, and these same farmers should see that the law named is enforced, if it is necessary, against the careless owner of lands where this duty is neglected. In some of our Eastern States, field crops are almost a failure, so far has this plant got possession of the land, and what is true there, will be the fate of the Pennsylvania farmers in the near future, unless we are alive to the suppression of this terrible pest.

FERTILIZERS AND THEIR USES.

By S. W. STEWART, *Pleasantville, Venango County, Pa.*

MR. CHAIRMAN AND GENTLEMEN: Before I got up I was proud of Venango county. Proud of her sons and the mental ability they have displayed on this occasion. But before I get through I fear my pride will have fallen. I only regret that this vexed question had not been consigned to some one capable of treating it as its merits demand. This question is one of interest to the agriculturist. Interesting because it is mysterious, and mysterious because we may not understand it. It frequently occurs that those things that are the most common and the most important are the least studied and the least understood. The importance of this question can be summed in one sentence: all vegetable substance is the result of fertilizers; no animal life could long exist, either on land or in the sea, without the immediate presence of vegetable substance.

The soil, in its natural or normal condition, contains the elements of fertility to a greater or less extent, drawn from bountiful nature's great storehouse of plant food. Were it not for this, the earth would be a desert, a barren waste. What the agriculturist desires is to add something to these, in order that he may produce a better and a more remunerative crop. Nature, when untrammelled by the innovations of man, performs her work upon strictly uniform and scientific principles.

All vegetable as well as animal life is the legitimate result of a harmonious assimilation of certain elements. We may, by certain mechanical processes or appliances, aid nature in performing her work, and by certain mechanical appliances we may entirely defeat the ends of nature in performing her work.

These are the cardinal points in this question of fertilizers. As to fertilizing, there are many ways and means of fertilizing, both by material appliances and mechanical processes. Thorough and judicious

cultivation is a means of fertilizing. So is underdraining and irrigation. The material appliances are mainly barnyard manure, green manure, or vegetable substance, and the commercial fertilizers. Gypsum, or plaster, is a fertilizer to some extent. Barnyard manure, from its nature and origin, we assume is the best fertilizer known, for two reasons: first, it contains all the elements of plant-food; second, to whatever extent it contains these they are there in their proper mechanical proportions. Such an application is always in harmony with the elements that are already placed by nature in the soil as plant-food.

The commercial fertilizer may contain many of the elements of plant-food, and many of them be entirely absent. Such an application creates a confusion in the elements and results in a failure. Or the commercial fertilizer may contain all the elements of plant-food, but not in the proper proportion. Such an application must be attended with a like disastrous result. In all our efforts to aid nature in performing her work, a harmonious equilibrium or proportion must be observed. It must exist; if not, our efforts will result in a confusion of the elements and a failure.

There is no confusion in nature. From the most distant planet through the entire solar system, all is controlled and held in place by a harmonious equilibrium. Were it not for this great principle in nature instantly our entire system would become a confused mass. The same great principle of harmonious equilibrium that holds our system in place controls the growth and production of the most minute spear of grass.

Gypsum, or plaster, as a means of fertility, is valuable on light and rare soils that have not the ability to attract and retain the necessary elements of plant-food. It should be used at all times in our barns; its density makes it valuable as a deodorizer and retainer, and its use adds largely to the health of our domestic animals. It holds or absorbs those foul odors that would escape high into the air to be brought back to the earth's surface as a fertilizer, with the falling rains and snows at some other time and in some other place. Philosophy teaches that there is nothing lost; but in many cases we are forced to the conclusion that there is great waste. There are millions in saving the wastes.

There is no class of the human family upon whom so much responsibility rests as upon the agriculturist. He stands responsible as a tenant under the greater lease that was given to the human family in the early hours of creation, with all its considerations and requirements. Responsible, indeed, for the existence of the human family, and the destiny of nations hangs upon his efforts. He should be familiar with the many elements and their blendings with the soil as plant-food; not alone as a stern necessity, but as a positive duty. He should be able to control these gases and vapors, and consign them to their proper places and in their proper proportion.

Then, and only then, will the agriculturists, as a class, be brought around from the *rear* of the world's grand procession and take their place in *front*, their natural and God-given place.

THE SELECTION OF COMMERCIAL FERTILIZERS.

By THOMAS J. EDGE, *Secretary State Board of Agriculture.*

In the selection of a commercial fertilizer for application to a crop, there are several items which should be carefully attended to. The time during which a fertilizer may act upon a crop is an important consideration in its selection. A fertilizer which has proven economical when applied to wheat may not be the proper one for corn; one has ten months in which it may produce its action and effect, while the other is limited to four; one is certain, at some period of its growth, to have sufficient moisture to release and utilize its soluble portions, while the other may not obtain sufficient moisture to render it of any service; one crop can economically utilize a slow-acting fertilizer, while the other can only be increased by one which acts rapidly and is readily soluble. Thus the same amount of money expended in fertilizers for these two crops may effect them very differently and this difference may cover all of the margin between loss and gain.

A fertilizer which exhausts itself in the formation of straw, while it may add to the bulk of the manure pile, assists very little in the formation and increase of the grain. From this we may infer that guano, alkaline salts, and such fertilizers as are rich in soluble and reverted phosphoric acid, will best suit the needs of our spring crops, and that the slower-acting fertilizer will produce the best results with wheat, and that ground bone will give the best results upon crops which have the longest period of growth.

Having decided upon the special ingredient needed in a fertilizer, the purchaser may lay down, as a rule, that the greater the percentage of this desired ingredient in the fertilizer, the more economical it will prove; by concentration both freight and handling are saved. If potash is the one ingredient desired, and no other is wanted, the purchaser who is guided by the analysis list of the Board of Agriculture will find that he may choose between muriate of potash (No. 49), and marl from Maryland. The former will furnish him with ten hundred and seventy-four pounds of potash to the ton, and the latter with but six and a half; the former furnishes it at a cost of four and one half cents per pound and the latter at the rate of one dollar and a half per pound; a difference well worthy of attention.

He will find the extremes of *available* phosphoric acid to vary in price from nine cents per pound in leading grades of dissolved South Carolina rock to forty cents per pound in No. 60; the variation in the cost of potash (ammonia) will be even greater. A careful examination of our table will prove our rule, that, as a general thing, the higher grades of each class are the most economical, and that by far the greatest percentage of fraud is in the lower grades of goods. In selecting fertilizers, always bear in mind that you are buying a certain number of pounds of certain ingredients, and that the less of other matter (which is practically adulteration) that you get, the better.

Having decided that acidulated South Carolina rock is his most economical fertilizer, the farmer will still bear in mind our rule. He has practically decided that available phosphoric acid is the ingredient

which his soil needs, and that is what he should buy. He will, as a rule, find that the brands which yield the largest amount of this ingredient to the ton are the most economical. Five per cent. goods will yield him but one hundred pounds per ton, while those yielding thirteen per cent. (and which can be readily purchased) will give him two hundred and fifty pounds per ton of the needed article; a comparison of the prices of these two grades will always show the higher grade to be the most economical. The same argument may be applied to the other ingredients (potash and nitrogen) with equal force.

In comparing the fertilizers as presented by the analyses recorded in our lists, care must be taken to compare articles of the same class with each other. Ammoniacal salts costing fifty dollars per ton must not be compared with South Carolina rock at twenty dollars: one furnishes nothing but potash and the other nothing but available phosphoric acid. Nor will it do to compare South Carolina rock costing twenty dollars with a complete fertilizer (containing all three elements) costing thirty-five dollars per ton: one furnishes but one element and the other all three. Wood ashes (as a source of potash) may be compared with muriate of potash or other potash salt, and after a proper allowance is made for freight and handling, the desired deduction may be arrived at.

In very many cases, when we add the cost of the freight and handling to the price of wood ashes, we will find that their potash will cost very much more than if obtained from some of the mercantile salts of potash; ashes have been imported from Canada and sold in considerable amounts in Pennsylvania, when analysis plainly proves that the potash thus obtained costs fully twice as much per pound as if muriate of potash had been used. This does not prove that under certain circumstances wood ashes may not constitute a desirable fertilizer, but we give it to show that care is needed in the selection of fertilizers, not only to get good material, but also to get it in its cheapest form.

If practice is to be taken as a criterion of belief, it would seem as if many of those who purchase fertilizers were desirous to obtain the largest *bulk* possible for a given amount of money; limestone at ten dollars per ton, marl at twelve dollars, crude South Carolina rock at ten dollars, and similar fertilizers seem to find enough purchasers to keep the goods on the market, notwithstanding both practice and theory prove that they are worth but a very small portion of the price demanded for them. Low grades of other kinds of fertilizers are purchased, often because they cost less per ton, the purchaser losing sight of the fact, that in them he is paying a greater price per pound for valuable material, and in addition is handling a large amount of worthless matter.

All of our experience in the analysis and practical use of fertilizers leads us to the conclusion that the percentage of fraud is much greater in low-priced fertilizers than in the higher-priced grades; that, discarding the acidulated South Carolina rocks from the competition, we will find that nine tenths of the fraud and adulteration is in fertilizers which sell for less than thirty dollars per ton; the exceptions are so rare that the rule is almost absolute.

In the purchase of fertilizers, the motto "the best is the cheapest" is just as true as in any other farm purchase, and should be made the key-note of the careful farmer.

DISCUSSION.

Mr. RUSSELL. I am not much of a speaker. I pretend to be only a working farmer. I have spent all my life upon the farm. I have used many different kinds of manures. I have also used fertilizers. I have also used gypsum or land plaster. I have almost quit using any fertilizers not made on the farm. Think I have made up my mind. Fertilizers cost too much. I don't think they are worth the price they cost in comparison to the good they do. I think manure is as good as plaster. It is just as good, and a good deal cheaper. The fertilizers that I use, I manufacture at home. I prepare it on the ground, and make my own fertilizers. Mr. Stewart has said manure from stock contains all the fertilizing elements. I don't just agree with him on all his points. If you have a poor place in your field, as was said yesterday, if you apply the good manure, it will be better, but not as good as the rest. While, however, your stock is good, you are making fertilizers to keep up your soil. This is my plan. One man said to me, if it contains all the ingredients necessary, we should use that alone. Then I want to speak about pig-pens. It is one of my hobbies. Farmers waste too much manure about home. No farmer ought to buy any fertilizers as long as he allows the waste to go on about the farm. I believe farmers don't get the benefit from fertilizers they should. They let more than one half go to waste. They should put the floors of their barns on the ground. I put my floors on the ground when I built my barns. It was the first of that kind in our country. They thought they would not do, but it was nineteen years last summer since I built the floor on the ground, and they are there yet, except one floor raised up from the ground; but some floors have rotted out three times, while the floor on the ground has not rotted out. Last summer I took up my one floor, and put in one of gravel together with clay. I could find a use for that to save manure in urine. I take this out and use it. You see a great many farmers in the country who let the best elements of the manure be wasted in the rains and carried away in the river. I am also an advocate of taking the manure to the field as soon as it is made at the barn, and scatter it in the fields as soon as possible. Some advocate mixing lime with manure. I don't do it. We may not be able to get it in the right proportions, and thus do more harm than good. Then we should save the manure from the chicken-house. It is a good manure. I think the farmers would do well to consider this point. Then construct your stables so that you can save all the manure. Every farm should have a compost heap to save the waste of the farm, house, and pen. Do not build the hog-pen across a creek so that the manure will wash away in it, as some farmers do. I used to build my pen across a creek, but I make now by saving the manure. There has been a good deal said about bringing up worn-out land. The best way is not to wear out the land. A good many farmers wear out land; then they have to go back and work hard to bring up their worn-out land. When I was young I took lessons in farming from a German. He said, "If you want to get rich, keep your farm waste." I took a lesson of him and followed it. I must keep mine for the sake of my boys. My friend Cochran said something about experimental farming. In New York State is said to be in a fine experimental farm. It is owing to the saving of everything about the place. If farmers should do the same, I believe we would have better farms. I believe farmers lose a good deal by leaving their bob-sled, tools, plows, reapers, etc., where they were last used, not to be used again till wanted, and by that time there is quite a rust formed. I don't want to tell much about my own sleds. They are almost as good as new, and are over forty years old.

Mr. PERRIN. Will you listen to me a moment while I tell you how to construct a barnyard? Reference was made by the last speaker of the use a man made of his hog-pen, to get rid of his manure. It reminds me of the experience of a young man in Tennessee, who wrote home that he was delighted with the country, and among other things he told how he had fixed his barnyard. He had constructed his pig-pen over a stream of water so it was all carried away in the stream. A very poor way. This is the way to construct your barnyard. You very rarely cart off the manure as made. You want to construct it in the form of a hollow saucer, so it will retain the urine, and so the rain-water will flow off. Then you should protect it by eave troughs. Now if you construct it in that way, I venture you would have one of the best barnyards in the country. This question fills people with economical views. If it was preserved carefully, it would be worth thousands of dollars every year to the farmers at this meeting. It is calculated that the urine of one cow is worth twenty dollars a year on the farm. There is another thing I wish to speak of in this connection. I object to the hay going from the farm. I instructed the man on my farm not to sell a dollar's worth of hay without my permission. You may have to scrimp for one year, you will be better for it next year. If you will wait one year the result will be a richer farm.

Mr. OLIVER. I believe in commercial fertilizers. I think the use of fertilizers is a benefit. The trouble of it is, we generally plant the fertilizer at the same depth for every kind of grain we raise. This results in poor crops. Corn, whose roots are near the top of the ground, should have the fertilizer near the top, while potatoes, whose roots are deep in the earth, should have the fertilizer deep in the earth. If we follow this out, we will have better crops. There was something said of an experimenting station. Experimenting stations are not good for this reason: they can not tell us what *our* soil needs to produce a crop, from the soil of *their* farm.

THE POTATO ROT.

By the SECRETARY.

During last autumn, and especially during the time at which the potato crop is usually stored in the cellar, our correspondents reported a number of serious cases of loss from "potato rot." Fortunately, these localities were circumscribed and limited, and the total loss was not nearly so great as was either feared or supposed. It was mainly confined to the southern and south-eastern portions of the State, but was also reported to a less extent in the northern tier of counties. Considered in the aggregate the loss was not large, but in some of the infected localities destroyed the larger portion of the infected patches. Some of our official correspondents estimated the total loss at ten per cent. of the crop of the State, but our examination, made outside of the infected localities and free from over-estimate naturally due to such causes, convinces us that five per cent. of our total crop will fully cover the loss from this cause.

A summary of the results of our examination, and a careful condensation of the correspondence relating to the topic, enables us to draw the following conclusions:

First. That the form of the disease which is styled distinctively the potato rot, is different from that form which is found each year in every patch, and which only affects a single tuber, and which does not extend, even in the bin, from that tuber to others. That the latter in no case develops into the former or more destructive form.

Second. That the destructive form is due to the rapid multiplication of a minute parasitic fungoid growth, which must in some way be kept alive, either in the tuber or in the soil, from year to year, and which never can originate in any locality or season.

Third. That the rapid development of this fungoid growth is increased or retarded by surrounding circumstances, and that the condition of the weather in relation to temperature and moisture has very much to do with the amount of injury done. That during moist or foggy and warm weather, the destructive element multiplies with great rapidity, and that its growth is retarded or stopped by cold weather.

Fourth. That the first place in which the fungoid growth can be detected is in or on the green leaves of the plant, which it will often, in a few days, affect very much as if a fire had run over the patch. At its first appearance this growth has the appearance of mould or light spots upon the most vigorous stalks and leaves; from these it extends to other portions of the plant, and finally to the tubers, with a rapidity which varies with the temperature and amount of moisture.

Fifth. That in a large majority of cases, if this growth is immediately removed with the tops, a large percentage of the crop may be saved. After starting on the leaves it rapidly multiplies, and by rains is soon carried down the stalks and on to or into the tubers, and the injury is done beyond repair.

Sixth. That as this microscopic growth which causes the disease cannot be originated or created, it follows that it must live over the winter or spring either in the tuber or in the soil. As to which of

these two is made the vehicle of carrying the disease over to the ensuing season scientists differ. A majority, however, hold the theory that it exists at all times and in all soils, and, like other parasitic growth, multiplies with great rapidity under favorable circumstances and surroundings. The initial plant may, and probably does, exist in the soil every year, but we only note its effects when its multiplication is so great as to attract attention by the loss which follows it.

Seventh. That this being the generally admitted theory, it is almost useless to expect that we can adopt any preventive measure for the destruction of the dangerous growth, at least before it shows itself on the plant. That all attempts to prevent it by certain advertised nostrums, introduced into the soil with the cut tubers, will be futile, and result in a waste of money.

Eighth. That after the disease has manifested itself, the following precautions, if carried out, may save much loss: At once dig the tubers, and store them in shallow piles on an open and airy barn floor out of the sun and moisture. Sort them over repeatedly, carefully removing all diseased tubers each time; dust them occasionally with dry air-slacked lime; handle carefully, and see that the piles are neither large nor high.

Ninth. After a season of this kind of decay, carefully, but *lightly*, dust all seed potatoes with air-slacked lime, so that, if possible, all the spores of the plant may be destroyed, and not planted with the cuttings to produce or start the crop for the next season's destruction.

Tenth. To dig the crop and store it in a cool, airy place, as soon as the fall showers come on, during warm weather. Get them out of the ground and out of the patch as soon as possible after the disease is manifested.

Prof. V. M. Spalding, of the State University of Michigan, thus describes the growth of this foe to the potato-grower:

The destructive effects of the fungus are generally first observed upon the tubers late in the fall; but the disease is present much earlier in the season, and may be recognized on the tops by a certain characteristic blotched, black or brown spotted, dead appearance. A critical examination would show on the diseased tops numerous small white spots, which, when highly magnified, are found to be miniature forests of slender stems growing out of the surface of the leaves and stems of the vine. These tiny stems produce spores (called "summer spores") by millions, so small that a million could easily lie side by side on a square inch without crowding. When ripe, they separate from the stem and fall, and under the influence of water become exceedingly active, and push out a slender tube capable of becoming a mature plant inside the potato plant.

The mature fungus lives in the tops or tubers of the potato, and is also microscopic. It consists of very numerous colorless irregular branching, tube-like threads, which grow through the tissues of the potato, appropriating its juices, and so impoverishing the tissues that they either break down directly or are invaded by bacteria and other low forms which induce putrefactive decomposition. The mycelium or internal tube-like thread of this fungus is perennial and hardy, but the disease depends, primarily, for its spread the following season upon the preservation of this mycelium in the diseased tubers and tops.

Several of our correspondents allude to a prevailing belief that a small portion of lime or wood-ashes deposited on and with the cutting will prevent the outbreak of the disease. If the initial growth of the fungoid plant is introduced with the cutting, we can readily see how this should produce the effect claimed for it, but if the spores of the disease are in the soil before the crop is planted, we fail to see how so local an application can have this effect. Rev. Marsena Stone, of the Leland University, at New Orleans, however, strongly advocates this plan, and writes in relation to it as follows:

My garden was touched by four others that had a patch of potatoes adjacent to my own patch in each. They were all planted in the usual way, using no preventive. I went to a lime-kiln in the neighborhood, and procured the wood-ashes with which the lime was burned, and which was mixed with lime, probably nearly or quite half-and-half, and dropped a handful of the lime and ashes with my potato seed, and when the potatoes were fairly up, I dropped upon each hill a small handful while the dew was on, two or three times while they were growing. The other four patches had very few sound potatoes. They lost nearly all, and I had scarcely a rotten potato, no more than is usual in a healthy field. It is a very easy experiment to try. I have not since had occasion to try it in Ohio, and know nothing more of the efficacy of the means than this single fact. But since four other gardens lay against mine, and nothing but a fence between the patches and mine, I cannot doubt that the test is a valid one.

In relation to this claim, there exists the standing objection that it is not safe to base a general principle upon the result of one test. It is quite possible (accepting the scientific theory of the growth of the *peronospora intestans*) that it may possibly have existed in the plots of Mr. Stone's neighbors and not in his own, and that, by some fortunate combination of circumstances, the spores were not carried to his plants. We could give one or two very similar cases where no ashes were used with the cutting, but where the fence seemed to separate the diseased patch from one not affected at all.

Some of our correspondents claim that they can trace this trouble to the use of certain kinds of fertilizers, and that plots planted with superphosphate alone have been free, while adjoining plots planted with yard-manure were almost entirely destroyed. This theory, also, needs a series of careful tests before we can accept it as correct. If, after a large number of experiments, it is found that phosphated plots are even, to a certain extent, exempt, it will be something gained, but so long as so many cases which disprove all such theories can be pointed out in every section of the State, we are compelled to receive all such assertions with a great degree of allowance.

END OF NUMBER